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NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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The Nation's Verdict

THE view we expressed on the eve of the poll that any forecast of the result of the General Election was unusually difficult in the face of the mixed condition of parties and opinions has been not only confirmed but emphasised in a surprising way. No single forecast we have seen has been anywhere near the mark, and the tame prophets at the various party headquarters were out of it even more than the average man. From the purely party point of view the unique position of having three big parties each at the mercy of the remaining two is no doubt annoying, and Mr. Baldwin, as a party manager, is getting liberally abused all round. But from the national point of view is the position so unsatisfactory as people say? And is it not possible that Mr. Baldwin has, by his unpopular appeal to the country, unexpectedly done something to stabilise conditions? Government on a three-legged basis is no doubt novel, but it may have its compensations, and it seems likely to continue. The two big political changes threatened have been prevented; no party can carry out any aggressive policy except with the consent of at least one rival; no party dare incur the unpopularity of forcing another appeal to the electors for some time to come. By this accident of circumstances, resulting in a balance of power, we may for a time at least get the "tranquillity" which so many desired, and trade may have a chance of going

quietly forward, as it has been doing for some time past. The total result, though tantalising to the party organisers, may not, after all, be so bad for the nation.

So far as chemical industry was represented in the contests there have been losses and gains. Sir Alfred Mond's defeat removes from the House an authority and a spokesman of unusual weight on questions of finance and industry. His withdrawal cannot be more than temporary, and in the meantime he has the satisfaction of seeing his son, Mr. H. Mond, in Parliament as the member for the Isle of Ely. Sir John Brunner resumes his Parliamentary work as the member for Southport, Dr. Clayton has been re-elected for Widnes, and Sir William Alexander has the high personal distinction of succeeding Mr. Bonar Law in a city with which he has been very closely associated. Had his party been returned to power, his experience as an administrator and a commercial man, and his weighty style as a speaker, admirably adapted, we should judge, to the House, would probably have given him an official place at once. In the London area, Mr. T. Miller-Jones had a hard task in the Limehouse Division, and failed against the Labour candidate. In South Islington Mr. C. S. Garland lost ground heavily, but Mr. Brotherton-Ratcliffe did remarkably well, making his appeal on a broad Liberal programme, and failing only by a small margin to capture the seat. Sir Sydney Henn, one of the few Conservative Free Traders, was returned for Blackburn again, but Colonel Astbury, Sir F. Sanderson and one or two others lost their seats. As things went, it seems regrettable that Sir Max Muspratt was not among the candidates, for his return would have distinctly strengthened the chemical group. Without entrenching on party politics one may express satisfaction that chemical industry is so well represented by some of its leading figures, and possibly occasions may arise on which their joint services may be of use in dealing with proposals affecting chemical interests.

Silica Gel and the Arc Process

SILICA gel and its application to industrial chemical processes has recently been attracting quite a lot of interest in this country, and the possibilities of its utilisation have not passed unnoticed in these columns. In view of the fact that the material is quite a topical subject for discussion just now in chemical circles, it will not be out of place to draw attention to some important experiments relating to its use in connection with the arc process of nitrogen fixation which have recently been described in the official journal of the American Chemical Society. The investigators (Messrs. E. D. McCollum and F. Daniels) point out that one of the simplest ways of quickly removing the products, before decomposition can set in, consists in blowing air through the arc very rapidly. There are, however,

two limits to this procedure—first, the extinguishing of the arc, and second, the difficulty of recovering the oxidised nitrogen when its concentration is low. It is the second problem only with which we are concerned at the moment, and the investigators point out that it may be surmounted by dispensing with the ordinary absorption towers filled with liquids, and by utilising in their stead vessels packed with silica gel. Since the cost of absorption constitutes about 25 per cent. of the total cost of fixing nitrogen by the arc process, the importance of such experiments will be readily appreciated.

In the case of these particular tests two silica gel absorption tubes were employed, and it is instructive to note that as the second silica gel tube showed no increase in weight, it was assumed that the recovery of the fixed nitrogen was complete. The first silica gel tube returned to its original weight after heating to 350° C., in a slow stream of air, and no nitric acid was observed either in the connecting tubes or in the tube surrounded by ice and salt in which the nitrogen peroxide was liquefied. These facts showed that all the fixed nitrogen was removed as nitrogen peroxide, even though some nitric acid may have been formed from the water on the silica gel. It was, in fact, possible to come to the conclusion that adsorption with silica gel offers an excellent method for the recovery of oxides of nitrogen from the arc, since in this way nitrogen peroxide may be removed from rapid air currents at low concentrations. By heating the silica gel the concentrated nitrogen peroxide may be recovered ready for liquefaction, or for absorption in water to give concentrated nitric acid. The silica gel is then ready for further adsorption.

Atmospheric Corrosion of Metals

It is a matter for surprise, when one really thinks about it, that right into the twentieth century we have been content to extend the use of constructional materials on a gigantic scale, with so little consideration for their relative corrodibility. A small committee which could marshal the available scientific knowledge and apply the simplest of business costing principles would almost certainly effect advantageous changes in the choice of materials for building, public works, and innumerable engineering purposes. Far too little attention is usually paid to upkeep expenses in relation to initial cost of installation. Comparing two metals, for instance, in the one case the initial cost may be less, but after the painting, repainting, repairing and perhaps even replacement are added it may frequently prove much less economical than a second metal which can be used without any protective coat whatever. The real problems of corrosion and their solution cannot, of course, be solved in this way, since much more fundamental knowledge of the causes and sequence of effects is required. There seems to be no doubt that still greater advances in the choice, treatment and use of materials, from the point of view of their resistance to corrosion, will result from systematic observation and experiments.

One of the most important researches on the subject is that being carried out by the Atmospheric Corrosion Committee of the British Non-Ferrous Metals Research Association. Mr. W. H. J. Vernon, B.Sc., the in-

vestigator, has just submitted his first experimental report, which is to be read before the Faraday Society in London on Monday next. The work to be described has been carried out under the supervision of Professor H. C. H. Carpenter, F.R.S., at the Royal School of Mines, and deals chiefly with the initial stages of corrosion—the tarnishing of metals. Quantitative measurements have been made on the relative behaviour of different metals and alloys, both indoors and outdoors. The subject is of great importance not only to those who are concerned in the manufacture of metal fittings and articles, but in its direct relation to labour-saving in daily housework. The investigation is by no means confined to tarnishing, which forms the outstanding feature of the first report merely because it represents the initial stage of corrosion. Exposure tests to outside atmospheric influences have been progressing since the commencement of the research, and will doubtless yield their quota of evidence in due course.

An American Opinion on Mining in Europe

It is always interesting to hear the American opinion of conditions in trade and technical circles in Europe, for from our experience we have generally found that those Americans who have been deputed to study the state of affairs prevailing over here have been particularly quick to grasp the salient points and to treat of them in an extremely fair-minded spirit. One of our most recent visitors has been Mr. George S. Rice, the chief mining engineer of the U.S. Bureau of Mines, who has lately completed a study, occupying several months, of conditions in the mining industries of Great Britain, France, Belgium, Poland and Czechoslovakia. Mr. Rice points to the fact that remarkable progress has been achieved in the reconstruction of the French mining industry, and, underground, the mines have recovered to such an extent that they are producing about 70 per cent. of the normal coal output. When all the water has been pumped out of the mines, the coal production of Northern France will be greatly increased over that of the pre-war period. In Great Britain and France the employment of rock-dust as a screen or barrier for the limitation of coal dust explosions to the immediate area of the explosion has been made compulsory, and in France powdered coal has been widely adopted as a fuel. In Germany, near Hanover, Mr. Rice found that novel methods are employed in the distillation of brown coal, a lignite quite different from American lignites, from which various oils, paraffin, and gas are being obtained. He remarks, too, that at Whitehaven, England, coal is being mined under the sea at a point four and one-half miles from the shore line.

As a result of Mr. Rice's visit to England, the British Government has already proposed that a joint programme of research, covering various mining problems, should be adopted. This programme would include the exchange of technical information of materials under test, of scientific apparatus, and possibly of research personnel. This proposal, moreover, has been accepted by America. Another interesting discovery made by Mr. Rice was that unique methods for obtaining petroleum, involving the mining of oil sands and their subsequent treatment at the surface, are being employed in Alsace and near Hanover. This makes

possible a greater recovery of the petroleum, two-thirds of which is usually left in the ground after ordinary extraction by wells.

Ethyl Chloride as a Refrigerant

THE Food Investigation Board set up by the Department of Scientific and Industrial Research has recently published a Report which deals with the thermal properties of ethyl chloride in relation to its use as a refrigerant. The Report gives the results of an investigation undertaken by Professor C. F. Jenkin, and should prove of general interest to industrial chemists, for, apart from its use as a refrigerant, ethyl chloride is used to some considerable extent for ethylation in the manufacture of dyestuffs and drugs and as a solvent. It has many features which render it particularly suitable for refrigerating work, for, with a boiling point of 12.5°C ., it may be quite readily handled in open vessels. Moreover, it has no appreciable action on either ferrous or non-ferrous metals employed in the construction of refrigerating machinery, although it has a most rapid and virulent effect on the majority of insulating materials, such as india-rubber. Undoubtedly the least attractive feature connected with the industrial use of ethyl chloride is its inflammability, and the comparatively wide range of its explosibility when admixed with air. There is, however, a means of controlling this drawback—namely, by introducing a comparatively large proportion of ethyl bromide. In this way, it is said, mixtures may be obtained which are of so non-inflammable a nature that they may actually be used for extinguishing fires. It is as well to recall that the selection of a refrigeration medium is primarily dependent upon the limits of volume, pressure, and temperature available, as well as on the general properties of the substance, such as its action on materials employed in plant construction, its poisonous tendencies, and inflammability. Perhaps the best-known substances lending themselves for the purpose are anhydrous ammonia, carbon dioxide, and sulphur dioxide, the two foremost being the most generally used. So far as carbon dioxide is concerned its critical temperature places certain restrictions on its use, and in connection with ethyl chloride it may certainly be claimed that since its vapour is non-poisonous (and only very slightly anæsthetic) it certainly is superior to liquid sulphur dioxide for this particular purpose.

A Great Success

THE Institute of Chemistry may be sincerely congratulated on the complete success of its arrangements for this year's annual dinner in London. It was an achievement to have brought together so distinguished a group of guests; it was an additional merit to have secured the broadcasting of the speeches by Lord Haldane, Mr. Chaston Chapman (the president) and Lord Burnham. The result has been, by means of the press and of our already rather wonderful wireless service, to make the work of the Institute known to an enormously large constituency and to give chemistry generally an effective but entirely dignified and beneficial advertisement. The whole scheme was equally well conceived and well carried through.

Points from Our News Pages

- Mr. H. M. Bunbury, M.Sc., in the first of a series of articles, discusses the constitution of colophony (p. 650). Results are published of Parliamentary contests in which candidates associated with chemical industry took part (p. 653). Lord Haldane, Lord Burnham, Mr. Chaston Chapman and others spoke at the Institute of Chemistry annual dinner (p. 654). A Research Chemist, who recently discussed "Activated Carbon," contributes some suggestions on the active principle in activated carbon and similar substances (p. 656). The hearing was begun on Monday of a claim by Dr. Levinstein and Professor Green to remuneration for the invention of mustard gas (p. 657). Dr. J. T. Hewitt, in a paper before the Northern Polytechnic Chemical Association, deals with the sources of raw materials for chemical manufacture (p. 658). The members of the Manchester Section of the Institute of Chemistry considered on Monday the question of the relation of chemistry to public life (p. 660). Business in the London Chemical Market is reported to be comparatively active and prices are expected to advance (p. 668). The November Board of Trade returns show an increase in both chemical exports and imports (p. 670). In the Scottish Chemical Market prices are well maintained, with German products inclined to go higher (p. 671).

Books Received

- LEAD. By Dr. J. A. Smythe. London: Longmans, Green and Co. Pp. 344. 16s.
COMMONWEALTH OF AUSTRALIA MUNITIONS SUPPLY BOARD. TECHNICAL REPORTS, 1921-1922.
MECHANICAL STOKING. By David Brownlie. London: Sir Isaac Pitman and Sons, Ltd. Pp. 234. 5s.
ORGANIC CHEMISTRY: PART III.—SYNTHESIS. By Cecil Hollins. London: Edward Arnold and Co. Pp. 412. 18s.
THE SUPERVISION AND MAINTENANCE OF STEAM-RAISING PLANT. By Charles A. Suckan. London: Ernest Benn, Ltd. Pp. 342. 36s.
THE SOURCE AND INFLUENCE OF IMPURITIES IN 80:20 CUPRO-NICKEL. By C. Blazey, M.Sc. Issued by Commonwealth of Australia Munitions Supply Board.
Food Investigation Board of the Department of Scientific and Industrial Research Special Report No. 18.—RED DISCOLOURATION (SO-CALLED "PINK" OR "PINK EYE") ON DRIED SALTED FISH. By P. C. Cloake. London: H.M. Stationery Office. Pp. 22. 1s.

The Calendar

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| Dec. | | |
| 15 | Chemists' Dinner arranged by the Birmingham and Midland Sections of the Institute of Chemistry and Society of Chemical Industry. 7 p.m. | The Queen's Hotel, Birmingham. |
| 15 | West Yorkshire Metallurgical Society: "Metallurgical Coke." Messrs. A. Jackson, T. Rose and G. Horley. 3 p.m. | Technical College, Bradford. |
| 17 | Chemical Industry Club: "Some Impressions of Soviet Russia." Major Barley. 8 p.m. | 2, Whitehall Court, London, S.W.1. |
| 17 | Institution of the Rubber Industry (London Section): "The Position of the Rubber Tyre Industry." Col. Sealy Clarke. 8 p.m. | Engineers' Club, Coventry Street, London, W.C. |
| 20 | Chemical Society: Ordinary Scientific Meeting. 8 p.m. | Burlington House, Piccadilly, London, W.1. |
| 21 | Society of Dyers and Colourists (Manchester Section): "The Dyeing of Cellulose Acetate." Mr. L. G. Laurie. | Manchester. |

The Constitution of Colophony—(I)

American Colophony and the Structure of Abietic Acid

By H. M. Bunbury, M.Sc.

Colophony, which is commercially known as rosin, is extensively employed in the chemical industry in the manufacture of paper, soaps, varnishes, etc. Its principal source is the long-leaf yellow pine, and recent attention which has been given to its constitution has now, according to the writer, elucidated a long-standing problem.

ONE of the most interesting and significant features of recent research is the number of investigations which have been undertaken in connection with products and processes which have long been of commercial importance. These have attracted the attention of the so-called academic workers in increasing numbers during the last few years. One has only to mention in illustration the cases of cellulose, soap, and paraffin wax. Another product coming within this category is colophony. Its commercial importance need not be emphasised, as its extensive application in the chemical industries is well known. It is produced on a commercial scale in several countries, notably the United States and France, but America supplies the bulk of the world's output. Its principal source is the oleoresin of the longleaf yellow pine (*Pinus palustris*). French colophony is derived from the oleoresin of *Pinus maritima*, which is known as Galipot. A certain amount of information regarding the chemical constitution of colophony has been available for some time. The problem has recently attracted further attention, with the result that, although definite constitutions cannot yet be assigned to all the constituents of colophony, most of the problems connected therewith have now been elucidated.

American Colophony

In presenting an account of recent work it will be convenient to consider American colophony first, since it is the most commercially important and the investigations have reached their furthest point with it. It has long been known that colophony consists of compounds, of an acid nature, as it dissolves in alkalis, giving salts such as the sodium resinate used in soap-making. The principal constituent is abietic acid, whose molecular formula is $C_{20}H_{30}O_2$. That some doubt has been entertained as to the validity of this formula is shown by the fact that as recently as last year Madinaveitia¹ supported the formula $C_{10}H_{22}O_2$ put forward by Easterfield and Bagley.² The large amount of analytical data previously existing has, however, been recently confirmed, and the formula $C_{20}H_{30}O_2$ can be taken as definitely established. As we shall see later, the acids present in colophony are susceptible to the action of heat and strong acids, giving rise to isomeric products, so that it is not surprising that different investigators using different methods of isolation and different raw materials have failed to obtain results agreeing with one another in all respects.

The acid constituents of the various kinds of colophony are termed in general colophenic acids; abietic acid is the most prominent and important member of this class. The acids originally present in the American oleoresin have not been closely investigated, and how far these are identical with the acids of the colophony has not yet been determined. More information on this point is available in connection with the French colophenic acids, as we shall see later on. Various methods have been adopted for the isolation of a pure abietic acid. Ruzicka and Meyer,³ following the method of Levy,⁴ distilled the colophony in a high vacuum (less than 1 mm.). Small quantities of turpentine and water were first obtained. (The presence of the former is to be expected, seeing that in commercial operations for the production of the best grades of rosin some turpentine is often intentionally left in.) About 90 per cent. distilled between 200° and 210° C. This distillate was recrystallised many times from acetone, giving finally an acid having m.p. 158° and $[\alpha]_D = -68^\circ$ (in EtOH). The yield amounted to about 50 per cent. of the total original distillate. The physical constants of this acid do not agree with those of the acids obtained direct from the colophony without heating, and hence it cannot be regarded as identical with the abietic acid originally present as such in the colophony. Thus we have

acids of melting points varying from 137° to 166° and $[\alpha]_D$ from +11° to +44° obtained by direct crystallisation of the colophony from acetone⁵; the colophony itself was weakly dextrorotatory. Henry⁶ obtained in a similar way an acid of m.p. 161° and $[\alpha]_D = +66^\circ$ from the colophony of *Pinus excelsa*. Steele⁷ isolated abietic acid from American colophony (WW) by boiling for two hours in 98 per cent. acetic acid; a yield of about 50 per cent. was obtained. Recrystallisation from alcohol or glacial acetic acid gave a product having m.p. 161–165° and $[\alpha]_D = -80.0^\circ$. Knecht and Hibbert⁸ also used glacial acetic acid at ordinary temperatures and recrystallised their product about twenty times from acetic acid, methyl and ethyl alcohols. Schulz⁹ by repeated recrystallisation of American colophony (Type H, $[\alpha]_D = +11.8^\circ$) from acetone and alcohol obtained dextrorotatory fractions with values of $[\alpha]_D$ up to +49°.

By treating this same colophony with alcoholic HCl in the cold Schulz obtained an acid of m.p. 171° and $[\alpha]_D = -96.8^\circ$. Further, Ruzicka and Schinz, by distilling in a high vacuum one of the acids obtained by direct crystallisation and which had m.p. 137–142° and $[\alpha]_D = +11^\circ$, obtained a distillate having $[\alpha]_D = -14^\circ$. Recrystallisation from acetone gave an acid of m.p. 154–156° and $[\alpha]_D = -20^\circ$. It is very clear from these results that the original acids in colophony and which are dextrorotatory are converted by the action of heat or strong acids into acids of levorotation. Further changes may be brought about; thus Ruzicka and Meyer (*loc. cit.*) by heating their acid (m.p. 158° and $[\alpha]_D = -68^\circ$) to 300° found that the rotation was reinverted, an acid of m.p. 170–172° and $[\alpha]_D = +46^\circ$ resulting. The continued action of hot mineral acids also considerably reduces the levorotation.¹⁰ All these different varieties of abietic acid have the same composition, as represented by the formula $C_{20}H_{30}O_2$, and are simply optical or geometrical isomers.

Acid or Anhydride?

A good deal of controversy has sprung up around the question of whether the abietic acid is present in the colophony as free acid or acid anhydride. Maly¹¹ first put forward the view that it was the anhydride, and Knecht and Hibbert, and more recently Steele, have lent support to it. Knecht and Hibbert have stated that it is probable that in the distillation of colophony *in vacuo* it is the anhydride that is obtained; the loss in weight on heating abietic acid to 180° in a current of carbon dioxide corresponds to that required by theory for the loss of one molecule of water from two molecules of acid. They also pointed out that colophony and its distillates do not crystallise well from anhydrous solvents; previously such solvents as ethyl and methyl alcohols, acetone and acetic acid had been those most frequently employed. Steele, in his isolation of abietic acid by means of 98 per cent. acetic acid, also assumed that the original acid was present in the form of anhydride, and put down the fact that he obtained an acid to the hydrolysing action of the acetic acid.

These views have now been shown to be erroneous. In the first place, with regard to the supposed hydrolysing action of the solvents used in the isolation and crystallisation of the acids, Schorger¹² has crystallised an acid (obtained by distillation of colophony in a high vacuum) from dry petroleum naphtha and obtained a good yield of crystalline product; titration gave figures corresponding to the formula $C_{20}H_{30}O_2$. As this is the accepted formula for the free acid and as there was no opportunity for hydration it must be concluded that

¹ Ruzicka and Schinz, *Helv. Chim. Acta.*, VI., 662, 1923.

² *J. C. S.*, 79, 1, 154, 1901.

³ *J. Amer. Chem. Soc.*, 44, 1, 333, 1922.

⁴ *J. Soc. Dyers and Colourists*, 35, 150, 1919.

⁵ *Ch. Zeit.*, 41, 666, 1917.

⁶ *Helv. Chim. Acta.*, V., 342, 1922.

⁷ *Annalen*, 149, 244, 1869.

⁸ *J. Amer. Chem. Soc.*, 45, 1, 339, 1923.

¹ *Anal. Fis. Quím.*, 20, 183, 1922.

² *J. C. S.*, 85, 1, 238, 1904.

³ *Helv. Chim. Acta.*, V., 315, 1922.

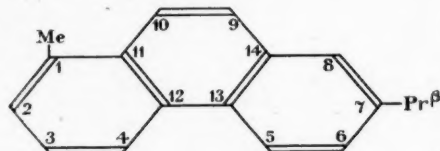
⁴ *Zeit. anorg. Ch.*, 18, 1, 739, 1905.

the original substance was free acid. It was shown, further, that sulphuric acid had no accelerating action in hydrating colophony in water—the opposite effect of what would be expected. Again, Ruzicka and Schinz (*l.c.*) have compared the acid obtained by vacuum distillation with that obtained by Steele's method, and have found the two almost completely identical; that obtained by the former method had m.p. 158° and $[\alpha]_D = -70^{\circ}$, and that from the latter m.p. $159-161^{\circ}$ and $[\alpha]_D = -77^{\circ}$. The two acids were identical in crystal form (monoclinic). Now Duffour¹³ has shown that the crystalline mixture of colophenic acids obtained direct from colophony (French) shows invariable characteristics, so that if the above-mentioned crystal identity is to have its full value as evidence it must be shown that each acid is a chemical individual. This Ruzicka and Schinz succeeded in proving. They employed two methods of separation. In the first they fractionally decomposed the aqueous solutions of the sodium salts by means of carbon dioxide. In the second they prepared the lead salts from alcoholic solution and then recovered the free acids. In both cases the acid recovered had unchanged melting point and specific rotation. Now if the original substance be anhydride, the distillate from it in a high vacuum would, *a fortiori*, also be anhydride and would differ accordingly from the "Steele" acid. Schorger has further pointed out that cases where two molecules of a monocarboxylic acid form an anhydride in the absence of a dehydrating agent are very rare, and rarer still are those giving a theoretical yield, as claimed by Knecht and Hibbert. The evidence is, therefore, sufficient to establish the fact that abietic acid is present in the colophony as free acid.

The Constitution of Abietic Acid

It has been known for a long time that the colophenic acids were derivatives of phenanthrene. In 1889 Bamberger and Strasser put forward the view that hydrophenanthrenes were probably normal constituents of rosin oils, a view supported by Krämer in 1903. The chief phenanthrene derivative referred to by these investigators is retene. Vesterberg, to whom much of our earlier knowledge of the colophenic acids is due, obtained a small quantity of retene by distilling abietic acid with sulphur.¹⁴ Little advance was made until Ruzicka recently took up the problem as an extension of his work on the sesquiterpenes.¹⁵

The work of Bamberger and Hooker,¹⁶ Fortner,¹⁷ Lux,¹⁸ and Bucher¹⁹ has shown that retene is 1-methyl-7-isopropylphenanthrene, $C_{18}H_{18}$.



Ruzicka and Meyer (*l.c.*) have confirmed the conversion of abietic acid to retene by the action of sulphur. The acid used in their investigations was that obtained by distillation of American colophony in a high vacuum as described above, and having m.p. 158° . It is, therefore, established that abietic acid is a derivative of retene. This fixes the positions of eighteen of the carbon atoms in the acid. It will be seen that the acid differs in composition from retene to the extent of two carbon, twelve hydrogen and two oxygen atoms. The two latter are, of course, in the acid (carboxyl) group, as is one of the hydrogen atoms and one of the carbon atoms. This leaves one carbon and eleven hydrogen atoms to account for, as well as two hydrogen atoms which must be eliminated from the retene to make way for the attachment of the two extra carbons, one of which is in the carboxyl group. This makes thirteen hydrogen atoms to account for altogether. By analogy with the behaviour of the sesquiterpenes eudesmol and seline we may assume at this point, as a working hypothesis,

that three of these hydrogen atoms are contained in a methyl group and the remaining ten are nuclear. On this assumption abietic acid is a methyldecahydroretene carboxylic acid.

Abietic acid is an unsaturated compound. This is shown by the facility with which it takes up iodine and bromine and decolorises permanganate. It forms a dihydrobromide.²⁰ There is, therefore, at least one double bond present. Reduction by Willstätter's method (H and Pt in EtOH) gave a mixture of two dihydro-acids, one of which was obtained pure and had m.p. 167° . This acid was saturated to permanganate as was an isomeric acid obtained from it by the action of HBr in acetic acid. This acid also could not be further reduced by hydrogen and platinum at 60° . By reduction in amyl acetate at 80° , however, some tetrahydro-acid was obtained. Complete reduction to a tetrahydro-acid was achieved with hydrogen in warm glacial acetic acid. These results point to the presence of two double bonds, one of which is, however, more stable than the other. It may also indicate the presence of one double bond and a fourth ring which suffers rupture in the reduction. Measurements of the refractive index of the methyl ester of abietic acid give values for the molecular refraction agreeing closely with those calculated on the assumption of the presence of two double bonds. The action of ozone on abietic acid results in the formation of a triozone; the dihydro-acid gave a diozone and the tetrahydro-acid yielded a mono-ozone after prolonged action of the ozone. These results are in agreement with the conclusion that the abietic acid is a doubly unsaturated compound. Against this we have the stability of the dihydro-acid to permanganate, but Virtanen²¹ has shown that several of the hydroretenes containing double bonds are also stable to this reagent. It is to be taken as established, therefore, that abietic acid contains two double bonds, but the positions of these are not yet definitely known.

We have seen that in the dehydrogenation process by means of sulphur two carbon atoms are eliminated, one of which is in the carboxyl group. The result of the dehydrogenation is also to convert the hydro-compound to the true aromatic or benzenoid structure (retene) just as the sesquiterpene eudesmol is converted to the benzenoid dimethylisopropyl-naphthalene. It is evident, therefore, that this carbon atom, which has so far not been accounted for, must occupy a position in the hydro-system which is no longer possible when the ring structure reverts to the true aromatic system. Such positions are the semi-cyclic methylene group, I., and the tertiary methyl group, II.



Now dihydroabietic acid cannot contain the grouping I. Such a grouping would be at once reduced, giving the group $(C_2)>CH-CH_2$. There is no reason why such a group should lose a carbon atom by the action of sulphur. As a matter of fact dihydroabietic acid loses a carbon atom on dehydrogenation with sulphur just as does abietic acid itself. This shows that the grouping I. is not present in abietic acid. It would thus appear that the carbon atom is in a methyl group attached to a tertiary nuclear carbon in the hydro-system, viz., one of the carbons 11, 12, 13 or 14 in the retene formula given above. Dehydrogenation in this case must result in the appearance of a double bond between the tertiary carbon and one of the other three nuclear carbons, thus rendering the attachment of the methyl group no longer possible. This result is analogous to those already established in the case of eudalene and cadalene.²² The dehydrogenation of abietic acid is formulated thus:—



It now remains to investigate the position of the carboxyl group. Nothing can be concluded from the splitting off of this group by the action of sulphur since, in general, aromatic

¹³ *Compt. Rend.*, 175, 109, 1922.

¹⁴ *Ber.*, 36, 4,200, 1923.

¹⁵ *THE CHEMICAL AGE*, Vol. ix., pp. 452 and 506.

¹⁶ *Annalen*, 229, 102, 1885.

¹⁷ *Monats.*, 25, 452, 1904.

¹⁸ *Monats.*, 29, 763, 1908.

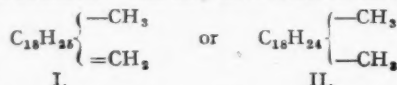
¹⁹ *J. Amer. Ch. Soc.*, 32, 374, 1910.

²⁰ *Levy, Zeit. anorg. Ch.*, 81, 145, 1913; *Henze, Ber.*, 49, 1,622, 1916.

²¹ *Ber.*, 53, 1,880, 1920.

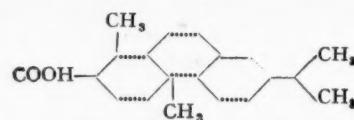
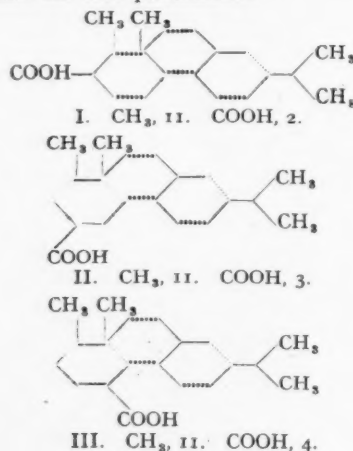
²² *THE CHEMICAL AGE*, Vol. ix., pp. 452 and 506.

acids lose carbon dioxide under these conditions. By the dehydrogenation of abietic acid methyl ester only retene is obtained. By reducing this ester by Bouveault's method (Na in EtOH) a primary alcohol, abietinol, is obtained. This also yields retene by sulphur treatment. By treating abietinol with phosphorus pentachloride a new hydrocarbon, $C_{19}H_{20}$, is obtained. This may have either of the formulae



Formula II. is the more probable on account of the tendency of the semi-cyclic bond (I.) to wander into the ring under the conditions of the experiment. The hydrocarbon may, therefore, be designated as a methylabietene. The important point to remember is that the new methyl group occupies the position previously held by the carboxyl group in the abietic acid. Dehydrogenation of this hydrocarbon yields a new phenanthrene derivative, $C_{19}H_{20}$, a carbon atom again being eliminated. No other product but this hydrocarbon, $C_{19}H_{20}$, was obtained. It may be considered to be a methylretene, $C_{18}H_{17}.CH_3$. Now the carbon atom split off in this case must be the same one as is eliminated in the case of abietic acid and its derivatives mentioned above. The remaining carbon atom, which must be the one originally in the carboxyl group, has withstood the sulphur treatment. The fact that this carbon atom is no longer eliminated when present as part of a methyl group shows that this methyl group, and hence the carboxyl of the abietic acid, is not attached to a tertiary carbon. Owing to the difficulty of esterifying abietic acid a primary carboxyl is highly improbable. There are two remaining possibilities. The carboxyl may be either secondary or else attached to a nuclear carbon carrying a double bond. In the latter case abietic acid would be an $\alpha\beta$ -unsaturated acid. Now Bouveault's method of reduction of $\alpha\beta$ -unsaturated esters always reduces the double bond. This is not the case with methyl abietate. Assuming that the rule applies to the case of abietic acid, it must be concluded that the carboxyl group is a secondary one. Further, the methyl group in the new methyl retene, $C_{18}H_{17}.CH_3$ is not attached to either of the carbons 9 or 10 since it yields a methylretene-quinone on oxidation with chromic acid. This is an ortho-quinone, giving the corresponding quinoxaline with ortho-phenylenediamine. It is thus clear that the methyl group in methylretene and hence the carboxyl group in abietic acid must occupy one of the positions 2, 3, 4, 5, 6 or 8 in the retene nucleus. This conclusion added to that already arrived at for the methyl group is as far as the direct experimental evidence leads us at the moment.

We can, however, draw certain conclusions from the evidence which has been established in connection with other terpenes and terpene derivatives. It has been demonstrated that all compounds related to the terpenes whose constitutions are definitely known can be built up from isoprene molecules. Applying this test to abietic acid, and bearing in mind the conclusions reached from experimental evidence, we see that there are four possibilities:—



IV. CH_3 , 12. COOH, 2.

The continuous lines represent in each case the skeleton of the isoprene molecule. Which of these formulae is the correct one has yet to be determined. Other formulae that have been put forward, such as those of Grün²³ and Madinaveitia (*l.c.*), are rendered untenable by the evidence of constitution adduced above and based on the results of the recent investigations of Ruzicka and his collaborators.

Chemical Merchants' Exhibition Stand Action by Contractors

In the Mayor's and City of London Court, on Thursday, December 6, before Judge Shewell Cooper, Beck and Pollitzer, haulage contractors, 133, Queen Victoria Street, London, sued R. W. Greeff and Co., Ltd., chemical merchants, Thames House, Queen Street Place, London, for £9 4s. balance of £48 for transporting a trade exhibition stand to Manchester, erecting, painting and touching it up, dismantling and returning it to London. The defendants counter-claimed £20 for work done to the stand. The claim was admitted.

Mr. Donald, for the defendants, said that the defendants frequently exhibited at various trade exhibitions. They sent their stand to the Manchester Trade Exhibition and employed the plaintiffs to take it there and bring it back. When it was returned, the stand had been damaged to the amount of £20, which was the subject of the counter-claim.

Mr. Noel Heaton, chemist in the service of the defendants, said that the particular manufacture they were introducing at Manchester was titanium white paint. Their stand was damaged by the plaintiffs, bottles being broken, paint being destroyed, and the beading being damaged. When the stand was erected it collapsed, falling on exhibits, breaking the glass cases and bottles of acids. He complained very bitterly to the plaintiffs about it, and told them he would hold them responsible. The carpet on the stand was also damaged with acid from the bottles. It was not true, he said in cross-examination, that the stand was a flimsy affair. Some of the demonstration panels were missing.

In answer to the counter-claim the plaintiffs called witnesses who said that the stand was not unreasonably damaged. It was impossible to remove the exhibition stand from London to Manchester and bring it back again without some damage being caused.

Judge Shewell Cooper said the contract price was £48, of which £38 has been paid. The plaintiffs were willing to allow £1 for damage to the stand, which reduced the claim to the sum now sued for. He thought the defendants' counter-claim had been very much exaggerated and having regard to the temporary nature of the stand generally, he was satisfied that there had been no unnecessary damage done to it during the time while it was going to Manchester and returning.

Judgment would be given for the plaintiffs on the claim and counter-claim with costs.

Dyestuff Imports in November

THE following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during November has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee: The total number of applications received during the month was 612, of which 485 were from merchants or importers. To these should be added eight cases outstanding on November 1, making a total for the month of 620. These were dealt with as follows—Granted 433 (of which 413 were dealt with within seven days of receipt); referred to British makers of similar products 119 (of which 105 were dealt with within seven days of receipt); referred to reparation supplies available 40 (all dealt with within two days of receipt); outstanding on November 30, 28. Of the total of 620 applications received, 558, or 90 per cent., were dealt with within seven days of receipt.

²³ Zeit. deutsch. Oel-Fett. Ind., 41, 49, 1921.

Chemical Interests in the Election

Losses and Gains

We give below the results of several Parliamentary contests in which the candidates were more or less directly associated with chemical and allied interests:—

Battersea (North)

| | |
|-----------------------------|--------|
| Hogbin, H. (L.) | 12,527 |
| Saklatvala, S. (Lab.) | 12,341 |

Liberal majority

Mr. H. Hogbin is a member of the firm of Lawes' Chemical Manures Co.

Blackburn (2)

| | |
|-----------------------------|--------|
| DUCKWORTH, J. (L.) | 31,117 |
| Henn, Sir Sydney (U.) | 28,505 |
| Davies, J. P. (Lab.) | 25,428 |
| Porter, E. (Lab.) | 21,903 |

Liberal majority

Unionist majority

Sir Sydney Henn is chairman of Lankshear, Wickstead and Co., manufacturers of tartaric acid.

Bolton (2)

| | |
|----------------------------------|--------|
| Law, A. (Lab.) | 25,133 |
| Cunliffe, J. H., K.C. (U.) | 22,833 |
| Hilton, Cecil (U.) | 22,640 |
| Edge, Sir W. (L.) | 22,173 |
| Eccles, F. (Lab.) | 21,045 |
| Steele, J. F. (L.) | 21,040 |

Labour majority

Sir William Edge is the head of a well-known dye firm.

Fulham

| | |
|---------------------------------------|-------|
| Vaughan-Morgan, Col. K. P. (U.) | 9,757 |
| Palmer, J. (Lab.) | 7,683 |
| Hawkin, R. C. (L.) | 4,817 |

Unionist majority

Colonel K. P. Vaughan-Morgan is a director of the Morgan Crucible Co., Ltd.

Glasgow (Central)

| | |
|---|--------|
| Alexander, Brig.-Gen. Sir W. (U.) | 13,392 |
| Mitchell, E. R. (Lab.) | 12,976 |
| Tennant, H. J. (L.) | 2,870 |

Unionist majority

Brig.-Gen. Sir William Alexander is the managing director of Charles Tennant and Co., Ltd., Glasgow, and chairman of the British Dyestuffs Corporation, Ltd. He was Director of Administration National Explosives Factories at the Ministry of Munitions, 1916-17.

Mr. H. J. Tennant is the youngest son of one of the founders of the firm of Charles Tennant and Co., Ltd.

Isle of Ely

| | |
|--------------------------------|--------|
| Mond, H. (L.) | 11,476 |
| Townley, M. (U.) | 11,009 |
| Hope, Lt.-Com. R. (Lab.) | 3,172 |

Liberal majority

Mr. H. Mond is the son of Sir Alfred Mond.

Islington (South)

| | |
|-------------------------------------|-------|
| Cluse, W. S. (Lab.) | 7,764 |
| Brotherton-Ratcliffe, E. (L.) | 7,531 |
| Garland, C. S. (U.) | 5,691 |

Labour majority

Mr. E. Brotherton-Ratcliffe is the head of a firm of chemical merchants. Mr. C. S. Garland is actively interested in several chemical organisations.

Lancaster (Darwen)

| | |
|------------------------------|--------|
| Hindle, F., Junr. (L.) | 14,242 |
| Sanderson, Sir F. (U.) | 11,432 |
| Thompson, E. G. (Lab.) | 3,527 |

Liberal majority

Sir F. Sanderson is a member of the firm of Wray, Sanderson and Co., Ltd.

St. Pancras (South-West)

| | |
|---------------------------------|-------|
| Barnett, Major R. W. (U.) | 7,097 |
| Horne, G. (Lab.) | 5,321 |
| Pilley, C. (L.) | 4,505 |

Unionist majority

Major R. W. Barnett is a member of the Council of the Institute of Petroleum Technologists and a director of various petroleum undertakings.

Salford (West)

| | |
|---------------------------------------|-------|
| Haycock, A. W. (Lab.) | 9,868 |
| Astbury, Lieut.-Com. F. W. (U.) | 9,742 |
| Morgan, G. Hay, K.C. (L.) | 6,097 |

Labour majority

Lieut.-Commander F. W. Astbury, who failed to retain the seat, as a colour user has taken an active part in the defence of the Dyestuffs Act.

Southport

| | |
|--------------------------------|--------|
| Brunner, Sir J. (L.) | 13,704 |
| Comyn-Platt, Sir T. (U.) | 12,776 |

Liberal majority

Sir J. Brunner is a director of Brunner, Mond and Co.

Stafford (Cannock)

| | |
|-----------------------------|--------|
| Adamson, W. M. (Lab.) | 11,956 |
| Thoneycroft, W. (U.) | 9,438 |
| Mander, G. (L.) | 7,465 |

Labour majority

Mr. Geoffrey Mander is a member of the firm of Mander Brothers, paint and varnish manufacturers.

Stepney (Limehouse)

| | |
|----------------------------------|--------|
| Attlee, Major C. R. (Lab.) | 11,473 |
| Miller-Jones, T. (U.) | 5,288 |

Labour majority

Mr. T. Miller-Jones is associated with the Invicta Works and treasurer of the Chemical Industry Club.

Stretford

| | |
|-----------------------------|--------|
| Robinson, Sir T. (L.) | 15,971 |
| Corlett, J. (Lab.) | 11,451 |

Liberal majority

Sir Thomas Robinson is a director of the Bradford Dyers' Association.

Swansea (West)

| | |
|-----------------------------|-------|
| Samuel, W. (Lab.) | 9,260 |
| Mond, Sir Alfred (L.) | 9,145 |
| Hewins, W. A. S. (U.) | 8,238 |

Labour majority

Sir Alfred Mond is a late director of Brunner Mond and Co.

Warrington

| | |
|------------------------------|--------|
| Dukes, C. (Lab.) | 12,984 |
| Reid, Capt. A. C. (C.) | 12,314 |
| Crowley, J. F. (L.) | 4,511 |

Labour majority

Dr. Crowley is a London engineer, with whose firm the late Dr. Harker was associated.

Westmoreland

Weston, Col. J. W. (U.). Unopposed.
Colonel J. W. Weston is a director of W. H. Wakefield and Co., explosives manufacturers, Kendall, and Nobel Industries, Ltd.

Widnes

| | |
|-------------------------------|--------|
| Clayton, Dr. G. C. (U.) | 12,808 |
| Cotter, J. (Lab.) | 12,020 |
| Ellis, H. T. (L.) | 2,355 |

Unionist majority

Dr. G. C. Clayton is a director of the United Alkali Co.

Wolverhampton

| | |
|---------------------------|--------|
| Bird, Sir R. (U.) | 15,990 |
| Brown, W. J. (Lab.) | 15,749 |

Unionist majority

Sir R. Bird is a member of the firm of Alfred Bird and Sons.

Institute of Chemistry Annual Dinner

Speeches by Lord Haldane and others

A DINNER which marked the 46th anniversary of the Institute of Chemistry was held at the Hotel Victoria, London, on Monday. Mr. A. Chaston Chapman, the President of the Institute, was in the chair, and there were present a large number of distinguished guests, representing the Houses of Parliament, Government Departments, the fighting forces, the Church, the law and business interests, whilst the chemical profession was well represented. Unfortunately, Dr. Voelcker, the Hon. Treasurer of the Institute, was unable to be present owing to indisposition, and a letter was sent to him expressing sympathy and the wish that his recovery would be rapid. Also Lord Milner, who was a guest, had to leave early owing to a small bone having lodged in his throat.

Lord Haldane on Science and Industry

VISCOUNT HALDANE proposed the toast of "The Institute of Chemistry of Great Britain and Ireland." In a reference to the present troublous times he had nothing to say with regard to the Parliamentary situation, except that he was perfectly convinced that this great practical nation, with its constitutional instincts, would make its way out of the difficulties in which it found itself. Coming to the Institute, he said it sought to combine science and organisation, and he knew of nothing of which we had a greater need. The growth and prosperity of the British nation depended much more upon science and organisation than upon controversies with regard to such matters as tariffs, which, however important they might seem, were bound to be ephemeral. This country was in a position, 70 years ago, which was much to be envied. It had national energy then, as now; it had raw materials, and sufficient for its necessities, and it had that wonderful set of people the British manufacturers and the British workmen. The science of the 'forties and 'fifties was an abstract science; it had very little relation to industry. It was not applied to industry and the manufacturers were able to get on very well without it. They were extremely practical and shrewd people in those days and they beat the world in production. Later the new discoveries of science began to be applied to industry. Dealing with Hofmann's work on synthetic chemistry, Lord Haldane said that we had rather under-estimated what the Prince Consort had tried to do at that time in fostering the development of chemistry. However, Hofmann was not listened to here, and he went back to Berlin; he was then established at Charlottenburg, and the result was that this country had lost £50,000,000 a year in trade in coal-tar products. But things had changed since then, and we now had the Imperial College of Science and Technology, an institution which ranks with Charlottenburg at its best. This century had been a most fruitful one. The production of young men of science in this country had gone on with extraordinary vigour, and there was an extraordinary amount of new science in the country. But we had to take warning. Speaking as a practical politician concerned with the future of the country, he said that if we did not develop science to the utmost, and, above all, see to its application to industry, we should fall far behind. We were a wonderful people, but there came a point when we could not prevail against knowledge, when science, knowledge and organisation were essential. He was of opinion that we had come to that time. The problem of the future was to see that more science was applied to industry, and that its application was organised in the best way. The future of this country depended upon knowledge and the enlightenment of the people. He had no doubt about our being able to hold our own in the world; the only doubt was how much we should suffer from going too slowly. He hoped that, as the result of the election, Parliament would be more interested in the diffusion of knowledge than Parliaments in the past had been. The privilege of proposing the toast of the Institute he welcomed, because the Institute had set itself to apply science to the affairs of the country and to organising its application. It was a great task and any body which set itself to do these things deserved well of the State.

Mr. Chaston Chapman on the Institute's Work

THE CHAIRMAN, in responding, thanked Lord Haldane, on behalf of the Institute, for the very warm and friendly manner in which he had proposed the toast. Enlarging upon the work of the Institute, he said it was formed in 1877 for the purpose of formulating a scheme of training for professional chemists, and of instituting examination tests whereby the proficiency of persons to practise chemistry could be adequately determined. The need for such an organisation was very widely felt, for at that time there was no profession of chemistry, using the word in the sense in which we employ it to-day, there were but few chemical practitioners other than professors in the universities and colleges, and there was no hall-mark by which the Government and the general public could distinguish between the competent and the incompetent. Although not exempt from infantile troubles, the Institute made steady headway, and in 1885 it was granted a Royal Charter, thanks very largely to the efforts of Prof. Odling, the then President. In virtue of the possession of the Charter the Institute was definitely authorised to examine, to grant certificates of competency, and to register persons qualified to practise. Since those early days the Institute had experienced no set-backs, and its record was one of uninterrupted progress and continuous service to the profession and to the nation as a whole. Perhaps the best proofs of the need for such an organisation were to be found in the strength of its membership roll and the recognition accorded to the Institute by Government Departments, by public and quasi-public bodies, and, indeed, by all who knew anything of its activities. To-day there are on the Register 1,615 Fellows, 2,714 Associates and 862 registered Students, totalling 5,191. The qualifications and examinations of the Institute are recognised and approved by all the principal Government Departments concerned with chemical appointments. To-day the Institute did not merely claim what it considered to be its rightful position among the great and older professional associations, but that position was being voluntarily and freely conceded on all sides. This recognition was based upon something more than certified professional competency, since one of the chief aims of the Institute was not only to maintain its very high standard, both in respect of the training it demanded of those who applied for admission to its examinations and in the character of the examinations themselves, but also to secure a high standard of conduct on the part of all its members.

Few things connected with the science to-day were more remarkable than the extraordinary development on the professional side which had taken place very largely through the instrumentality of the Institute during the past thirty or forty years. Order had been evolved out of chaos, and in that short space of time a great and powerful profession had been built up. Whether we regarded chemistry as a subject of study essential to an understanding of the world, as an agent which had done so much to transform the life of man, as one of the most powerful factors in the creation of material wealth, or as that department of knowledge on which our national prosperity and our national security so largely depended, its supreme importance was equally manifest, and that importance it must be our business to make the nation understand. When we realised the stupendous part which chemistry had played and was destined to play in human affairs, and when we remembered how much it might be made to contribute to the progress and welfare of the whole human race, it should be regarded as a privilege by those who were in the happy position of being leaders of the people to do all they could to foster its development and to widen the sphere of its influence. Members of the Institute were specially interested in this aspect of the matter, since the prosperity of the Institute must clearly depend upon the extent to which the importance of chemistry was recognised by our rulers, by our industrialists and by the great body of the general public. He would not say that during the war the Institute was actually discovered, but, for the first time, the nature of its activities and its great usefulness were widely recognised; the Institute was the chief mobilising agency for all purposes in which chemistry was concerned, not only in

relation to the active forces for offence and defence, but also in connection with the no less important matter of the production of munitions and other materials of war. Notwithstanding all this, could it be said that since the termination of the war the influence of chemists as a body had increased? He believed not, but rather the reverse. He asked the many distinguished guests present to do what they could to increase, in the interests of the nation, the general knowledge and better understanding of the services which chemistry was ever rendering to the community.

Professor Smithells

Professor ARTHUR SMITHELLS, proposing "The Houses of Parliament," said that, in addressing such a distinguished assembly of guests, representing a great variety of representative institutions—not only the Houses of Legislature, but the Church, the Army, Navy, Air Force, the Civil Service, the Press, and other interests—it was impossible for a chemist not to feel conscious of the neglect which his science suffered at their hands, and to attempt to pronounce to each in turn a suitable homily on the importance of chemistry. Whilst he did not suggest an alteration in the composition of the Houses of Parliament which would include an influx of chemists, it was eminently desirable that science should be more diffused amongst those who had to enact the laws of this country. On behalf of the chemists present he said they were sensible of the debt they owed to the men who devoted their lives to service in the Houses of Parliament, and felt the utmost sympathy for them in the times through which we were passing. He paid a tribute to Viscount Haldane and Mr. Robert C. Nesbitt, M.P., whose names he coupled with the toast.

Viscount HALDANE, replying on behalf of the House of Lords, said that, on the whole, the proceedings of that House, if not always brilliant, were generally sane. Nobody knew what the future would bring forth, but if it brought forth any changes of a striking nature, his opinion was that the House of Lords would prove itself equal to the emergency. He awaited the future with feelings of tranquillity.

Mr. ROBERT C. NESBITT, M.P., responding for the House of Commons, said that so far the present House of Commons had done nothing to which any person could possibly object. (Laughter.) The House of Commons, no matter how it was composed from time to time, was the greatest legislative assembly in the world. The presence of three parties, no one of which was able to carry through any policy which it had set its heart on, might well call for some other method of electing the members than we have at present, and, though he expressed no opinion, the system of proportional representation might be a matter for consideration. After expressing a wish that there were more scientists in the House, he thanked the gathering for the way in which the toast was received.

Sir Robert Robertson

Sir ROBERT ROBERTSON proposed "The Forces." He recalled that in the thirties of the last century the War Office maintained chemists to advise them, but the Forces employed many more at present. Not only was the improvement a numerical one, but there had been brought into the whole scheme of things a spirit of co-ordination which was perhaps not so evident before. He emphasised the need for constant review by the Services of chemical products, not only at home, but Imperial and foreign, from the point of view of seeing that this country was well provided in respect of them. He coupled with the toast the names of Capt. Henley (Director of Naval Ordnance), Lieut.-Gen. Sir Noel Birch (Master-General of the Ordnance), and Air Vice-Marshal Sir W. G. H. Salmond.

Capt. J. C. W. Henley (Director of Naval Ordnance) responded for the Navy and conveyed its sense of gratitude for the work of the industry of chemistry; the Navy realised that, without the backing of knowledge and science, they would be nowhere. Hitherto, perhaps, they had failed to appreciate fully the value of science and research, but they had learned their lesson, and the policy of the Navy was to encourage and to benefit by science and research to the very utmost.

Lieut.-Gen. Sir NOEL BIRCH (Master-General of the Ordnance), for the Army, said no one would contradict the statement that the chemists saved this country from defeat in the Great War. When the Germans had attacked our troops with gas our chemists had assisted the Army and had answered the supreme test right royally. After sacrifice of life and health they had provided defensive measures, after which they had taken the offensive and had beaten the German at his

own game. As Master-General of the Ordnance he would always do his best to get as much money as he possibly could applied to research. (Applause.)

Chemistry in the Air Force

Air Vice-Marshal Sir W. G. H. SALMOND referred to the dependence of the Royal Air Force upon chemistry. Illustrating the contributions that chemistry had made to the art of flying, he referred to dope, which was entirely a chemical product; the chemist had also got over the difficulty connected with the poisonous nature of the ingredients used in its preparation. Other chemical products used by the Air Force were the varnish used on propellers, petrol and oil, liquid oxygen, and so on. Again, now that we were developing metal aircraft, the lives of the pilots would depend on the satisfactory solution of the problem of corrosion, which was a problem for the chemists. For all this, he was glad to have the opportunity of offering a tribute to the Institute of Chemistry.

Sir HERBERT JACKSON, proposing "The Civil Service," said that the Service was most criticised by those who knew it least, and that those who knew it best held it in the highest esteem. He referred to the cordial relations which had existed between the Institute of Chemistry and the various Government Departments with which it had come into contact, and coupled the toast with the name of Sir L. Amherst Selby-Bigge (Board of Education).

Sir L. AMHERST SELBY-BIGGE (Permanent Secretary, Board of Education), responding, said that the Civil Service were well content to be judged by those who knew them, as did the Institute. The Institute had, with admirable public spirit and considerable practical wisdom, been willing to take a responsible share in solving the problem which was always before the Board of Education, of getting better value for the public money spent on education. He believed the Institute and the Board were in agreement in believing that at the root of the application of science to industry there lay as an absolute essential a good general education, unprejudiced by premature specialisation. As regards the methods and principles which should be followed in scientific education, he believed there was not a "ha'porth" of difference between them. It was a very good augury for the future of organised science and organised industry that a great Institute such as this, composed of practical scientific men constantly engaged in solving practical problems of education, should step down and help Government Departments to do their work. We had made a beginning in the last few years of that close co-operation which ought to exist between Government Departments and the great professional and scientific institutes of the country, and he saw no reason why it should not go further.

Saving through Science

Viscount BURNHAM proposed the toast of "Science in Industry." He was glad to think, he said, that the benefit of the trained mind as well as of the trained hand was being recognised by the employers of the country more and more every day. There were no more convinced believers in technical education based on general knowledge than the enlightened captains of our industries to-day. Science had saved its cost in money a hundredfold. No works could be efficient or progressive without a works chemist; he knew what the works chemist meant in paper mills. Until lately they were in the old rut of customary usage, but had now reorganised man power and increased brain power. Schopenhauer had said "Philosophy never saved me a sixpence," but he (Lord Burnham) could say unhesitatingly that science saved us all even more than we could possibly get from the Capital Levy. To-day the chemist could—and he would if he could—save and fructify the State. He coupled with the toast the name of Sir John Brunner.

Sir JOHN F. L. BRUNNER, M.P., responding, agreed that we were improving in the matter of the application of science to industry. The reason why the heads of businesses had hesitated in the past to engage a highly trained chemist was that they would not have known what to do with him when they had got him. To-day the heads of businesses were better equipped. They were able to discuss with the technical staff the problems which came before them. Having been elected a Member of Parliament, he hoped to be of use to the profession. (Hear, hear.) Science in industry must go on. Science had vastly helped industry, and he believed it could be said that it had made modern industry. For his own part, as an industrialist,

he said that industry must help science, and he appealed to industrial undertakings which were able to do so to find the means whereby it might endow research; the universities wanted money to enable them to carry on their daily work of research. This was all the more necessary because it had been said that Governments were still apathetic. Professional and business men, he hoped, would co-operate heartily together in the future and contribute towards putting our country in the forefront of technical progress.

Sir WILLIAM POPE proposed the final toast, "The Guests," and said that the Institute was fortunate in being able to welcome such a distinguished list of guests. It was a very welcome sign that a chemical gathering should be able to collect together so many distinguished men who had been in the forefront of the activities of the Empire during the last

fifty years. He paid tributes to Dean Inge and to Lord Justice Sargant, whose names he coupled with the toast.

The toast was responded to by Dean Inge and Lord Justice Sargant, who expressed their thanks and those of the other guests for the manner in which the Institute had entertained them. Lord Justice Sargant referred to the fact that, owing to his recent promotion, he had had to give up the Chairmanship of the Royal Commission on Awards to Inventors, which was a matter of very great regret to him. For four and a half years he had been associated with a number of the pleasantest and most capable colleagues that any man ever had, including Sir James Dobbie (the late President of the Institute) and, later, Mr. Chaston Chapman. They had to create their own precedents and put matters, as well as they could, on a scientific basis.

Surface Action in the Chemical and Petroleum Industries

By a Research Chemist

On October 6 we published an article on "Activated Carbon and Its Uses," which attracted some interest. In the present contribution the same writer offers some suggestions which he believes to be more or less original on the meaning of the active principle in activated carbon and similar substances.

ONE of the prominent features of modern industrial chemistry is the increasing use made of contact processes. Many of these processes are catalytic in character, but outside of those termed catalytic are some of great industrial importance typified in the use of silica gel and active carbon. The term surface action, as employed in this article, is used to include the action of both kinds of material.

Surface action is, of course, far from being a recent discovery. Probably the first scientific recognition of surface action was made by Humphrey Davy in 1817, when he observed that platinum foil hastened the combustion of inflammable gases. The discovery by Dobereiner shortly afterwards that spongy platinum was much more effective in accelerating such reactions than sheet platinum may be said to have established the catalytic principle which has come to play so large a part in modern industrial chemistry. Although a knowledge of surface action has thus existed since the days of Davy and Dobereiner, it is only now that we are getting a glimmer of light as to its meaning.

The phenomena of catalysis have been much discussed by Sabatier and others, and the two prevailing ideas of them—that is, the intermediate compound theory and the mechanical theory—are well known. But surface action, not generally regarded as catalytic, has received less attention, and the remarks that follow will include a suggestion that both kinds of surface action are of the same type, and will also refer to some evidence which supports this view.

It is already known that even "active" substances such as silica gel and activated carbon can act catalytically. An example is furnished by the action of these bodies in removing hydrogen sulphide from coal gas. In the presence of a small quantity of free oxygen, the adsorbent—silica gel or active carbon—decomposes the sulphur compound within its pores to elemental sulphur and water. But generally the catalytic property of such substances is not regarded as of great importance.

Activated adsorbents act on gases and vapours in two different ways. Absorption takes place by capillary attraction, and this absorptive property is shared by a large number of finely porous substances which are not regarded as "active" in the sense in which that term is now understood. This absorbed gas is easily removed from such material, and usually a quite moderate heating suffices. But with really "active" material there is not only absorption due to capillary attraction, but a specific adsorption due to the active principle. Gases or vapours which are held by this latter force are retained much more tenaciously, and their removal from the adsorbent is therefore more difficult. Absorption of gases or vapours as distinct from adsorption by the active principle, is probably entirely physical in character. But adsorption seems to be a phenomenon of a different nature.

The Meaning of Adsorbent Action

A clue to the meaning of adsorbent action seems to be given by Langmuir. As long ago as 1916 he propounded a theory in

the Journal of the American Chemical Society which still remains the most generally accepted. This theory, so far as it deals with the ultimate structure of matter, has now become familiar, and need only be referred to so far as it appears to have a bearing on the subject under discussion.

Langmuir holds that chemical combination between two atoms is due to the sharing of a pair of electrons, which is usually described as valence. But beside valence there must be a residual field of force to account for combination, such as AgMg_2 ; silicates, simple and complex; water of hydration and crystallisation; and many other combinations which appear to be outside the law of valence. This residual field of force can be regarded as a kind of secondary valence. It comes into play in crystal formation in which the identity of a molecule is lost by every atom being chemically combined to all the adjacent atoms. In each individual molecule the primary valences of the constituent atoms are regarded as satisfied, so that the cohesion of the molecules to form the crystal seems to depend upon the residual field of force or secondary valence.

There are two recognised types of compound: one has been styled "non-polar," and includes compounds like CH_4 due to primary valence, in which the residual fields of force are practically negligible, and "polar" compounds such as CaO and NH_3 in which secondary valence permits the formation of loose combinations such as are exemplified in their hydrates. In the polar type of compounds the residual fields of force possess varying degrees of strength. Taking CaO and NH_3 as examples: in the one case the combination of the lime with the elements of water is comparatively strong and exothermic in character, thus requiring a strong heating to separate them. At the same time it may be remarked that the water of hydration is rather easily displaced by a weak acid radicle such as CO_2 . In the case of ammonium hydrate, however, the combination of water and ammonia is so weak that mere exposure to air at ordinary temperatures will soon bring about a complete separation. Moreover, the hydrate can only exist in solution.

While both calcium hydrate and ammonium hydrate are recognised chemical compounds, one of which possesses considerable stability, it seems not unreasonable to the writer that the field of residual force referred to as secondary valence might form a kind of compound in certain cases which would not be recognised as a chemical compound in the ordinary sense. Such a compound might be formed in cases where the secondary valence was a relatively weak force—too weak to form any kind of combination possessing stability comparable with that of hydrates.

To return to Langmuir's work, since confirmed by other workers, it has been shown that the atoms on the surface of a crystal take up a regular spacing, and form a pattern which has been described as a chessboard effect. Non-crystalline bodies like glass and other vitreous solids show no such regularity,

while bodies like platinum black will show filaments and interlocking chains with a quite indefinite face.

But whatever the structure of the solid body may be, it is only those atoms which are at the actual surface that can display any degree of residual force, because we have seen that the atoms in the interior have such forces neutralised in cohesion. The atoms actually at the surface, however, have not lost this force because they are free, at least, on one side, and it is these which come into play in catalysis and adsorption.

Monomolecular Films

Gases or vapour molecules, in approaching such a surface, will be propelled by their kinetic energy, but are opposed by the repulsive action of the solid surface and generally have to retreat. But some effect a collision, and in so doing part with so much of their kinetic energy that they are unable to escape. These form a film which is often molecular or one molecule thick and seldom more than a few molecules thick. A film once formed prevents others from forming, and thus there is a limit, usually soon reached, when no further molecules of the gas or vapour can stick, and they rapidly evaporate. When this stage is reached we say that the adsorbent is saturated or the catalyst is poisoned as the case may be. It is the formation of monomolecular or at any rate extremely thin films that accounts for the much greater effectiveness of a catalyst or "active" material when it presents a relatively large surface such as is furnished by fine division or by a multitude of fine pores. For example, the catalytic property of platinum is greatest when it is suspended in a liquid in the colloidal state. According to J. Alexander (*Chemical and Metallurgical Engineering*, February 1, 1922, p. 206), a solid cube of 1 cm. edge, with a surface area of 0.93 square inch, would have a surface of the order of 93,000 square inches if dispersed in colloidal form.

The surface presented by a similar cube, say, of activated carbon, is certainly less than the above figure, but many hundreds of thousands of times greater than if it were non-porous.

Langmuir found that tungsten wire heated to 3,500 K. (thermodynamical degrees in Kelvin units) in the presence of hydrogen caused dissociation of the hydrogen molecules colliding with the tungsten surface. One atom of the molecule condensed on the surface of the tungsten to form a hydrogen film, and the other atom was reflected. In the cases of oil films containing active groups like -COOH or -OH, the molecules are oriented so that the hydrocarbon tail stands up erect. Langmuir shows that it is these films of single layers of oriented molecules that are responsible for most cases of surface catalysis.

The methods by which Langmuir obtained his results must be studied from his published statements. These are not easy to follow even by technical workers of average attainments, but accepting his results as more or less proved, one gets an inkling of what happens in cases of catalysis and adsorption. It seems certain that in all these cases something more than physical action is involved. The action, if not strictly chemical as that term is understood, is really of the same character. Some kind of combination differing from mere physical contact takes place between the gas or vapour molecule and the molecule of the adsorbent, but the substances formed are far too unstable to permit of their isolation and examination by current methods. The life of these combinations in catalysis is particularly brief, but in adsorption cases they are of a more permanent character and more nearly akin to ordinary chemical compounds. Briefly, in considering catalysis and adsorption, we appear to be brought into contact with a kind of chemical combination which is far weaker than anything met with in ordinary chemical experience. The compounds formed are secondary valence compounds, but not the strongest of these combinations. They are combinations between molecules in which the residual fields of force, after the satisfaction of the demands of primary valence, are so weak that the compounds formed are too loosely held together to permit their examination or even identification by known methods. At present this idea is without absolute proof. If it can be shown by some method yet to be evolved that an adsorbed film of gas or hydrocarbon vapour reacts differently from the same substances in the free state, the view expressed in this article might be considered as proved.

The Invention of Mustard Gas

Claim by Professor Green and Dr. Levinstein

ON Monday, in the Chancery Division, High Court of Justice, Mr. Justice Tomlin, presiding over the War Inventions Committee, heard the claim of Dr. H. Levinstein and Professor Green as to mustard gas. It was contended for the claimants that the gas was the only product of this class which was used by the British Army. The invention was made on a large scale at the works of the British Dyestuffs Corporation, Ltd.. At the request of the Government the applicants supplied all information at their disposal and their working drawings to the Government of the United States free of charge, and thus enabled their product to be manufactured on an immense scale without delay. In the same way the invention and drawings were placed at the disposal of the Italian Government. The applicants charged no manufacturing profit and no royalty in supplying the Government with the substance.

Sir Duncan Kerley, K.C., and Mr. R. Moritz appeared for the claimants; and the Attorney-General, Mr. J. Hunter Gray, K.C., and Mr. W. Trevor Watson represented the Government.

Sir Duncan Kerley said that neither of the claimants had received one penny or any acknowledgment in respect of the part they had played in the production of this gas. The British Dyestuffs Corporation, although they were paid, had made a loss on the whole transaction.

Mr. Hunter Gray said the Crown maintained that this invention was in fact covered by an existing patent.

Original Process Unpracticable

Sir Duncan Kerley said the process of the applicants differed chemically from the patented process invented by Professor Pope. At the first attempt to make a large quantity of the gas the whole potful bubbled up and got out of its container, and, but for the fact that a covered catchpot had been provided, every man on the job would have been killed, and the works themselves would have been unapproachable for weeks. In May, 1918, they were told that nothing could be of greater military importance than a quick supply of mustard gas, as our troops were being discouraged by the fact that the Germans had got this stuff, while we had none. In the attempt of the Ministry of Munitions to make the gas at Avonmouth there were 1,400 casualties.

As to the value of the product, Sir Duncan Kerley said it was used for the first time in the field in September, 1918, in the artillery preparation for the Fourth Army attack on the Hindenburg line. Two nights before the attack several villages near the line and many strong points and gun positions were shelled with mustard gas for six hours. In the latter case the effect of the gas was seen at once, as the hostile batteries ceased fire and remained silent for 24 hours or longer. It was a long time before the Ministry of Munitions were convinced that their (the claimants') process was the proper one, and that they were producing the proper stuff. But at last they were convinced, and Professor Gibson was sent to Avonmouth to install the Blackley process and to produce the identical product which they were preparing at Blackley. It did not diminish the value of their service that the Ministry would not believe them, but the Ministry were eventually driven by their own want of success to adopt the Levinstein method. As to compensation, on the stuff produced at Avonmouth, which amounted to 545 tons, and which was produced by imitating their methods and their products, not a penny had been paid to the claimants. A royalty of a penny per lb. on the total production would amount to £5,000.

Dr. Herbert Levinstein, in reply to Mr. Moritz, said that he was managing director of Levinsteins up to its amalgamation with British Dyes, and afterwards technical director of the latter company until February, 1921. There were several methods of making mustard gas. From the starting of operations at the end of June they were continuously at work at Blackley until the Armistice, and they delivered supplies without a hitch.

The hearing was adjourned to Monday next.

A Toronto Research Fellowship

A RESEARCH fellowship at Toronto University, worth £240 a year, has been endowed by the Hollinger Gold Mines. It is to be awarded to a graduate student in the research laboratory of the Department of Mining Engineering.

Sources of Raw Materials for Chemical Manufacture*

By Dr. J. T. Hewitt

THE most fundamental chemical compounds with which the manufacturer has to deal are (1) the common acids, (2) caustic and carbonated alkalis, (3) ammonia, (4) chlorine and chlorine-giving compounds, (5) salts of metals.

These will generally be classed as inorganic, whilst of inorganic materials used on the large scale we have those derived from (6) oils and fats, (7) hydrocarbons, (8) alcohols. Further than this, we have to deal with various plants from which alkaloids or "principles" are extracted, whilst several minor sources of materials will doubtless occur to many.

Sulphuric Acid

Of all chemical compounds, sulphuric acid is possibly the most important. Originally this acid was obtained (usually in a fuming condition) by roasting green vitriol in the air and distilling the resulting basic ferric sulphate from clay retorts; the process was employed in the Bohemian works of J. D. Starck until the end of the last century for the production of fuming acid or oleum. The ferrous sulphate was itself obtained by the weathering of pyrites, which must consequently be looked on as the original raw material.

In order to obtain the acid more cheaply the process of burning sulphur mixed with saltpetre in glass globes containing some water was adopted (said to have been introduced into England by Cornelius Drebbel) so that the raw material now became sulphur instead of pyrites. Sulphur, as raw material for making sulphuric acid, continued to be used after Dr. Roebuck (1746) of Birmingham had replaced the glass globes by leaden chambers (6 ft. square), and after Chaptal had made the process continuous by using burners outside the lead chambers, introducing steam instead of water, and generating the nitrous fumes by decomposing nitre in a separate vessel. Except in such cases that an acid containing free sulphur trioxide was required, sulphur continued to be the raw material from which sulphuric acid was generally made.

The supply of sulphur was almost exclusively Sicilian, but the attempt of the Sicilian Government to extract exorbitant prices from the consumers led to the roasting of pyrites and utilisation of the sulphur dioxide so produced in the manufacture of sulphuric acid. This opened the way to the utilisation of other metallic sulphides, and whilst, formerly, zinc blende was roasted in the open and the sulphur dioxide allowed to escape, the operation is now generally conducted in conjunction with a vitriol plant, not only for the sake of the sulphuric acid, but also to avoid the nuisance created by the escaping fumes.

The greater part of the sulphuric acid manufactured in this country has been made from pyrites until recently, although in America the large deposits of free sulphur have been extensively employed. Here in Great Britain recent alterations in relative values have led to considerably greater use of sulphur as a source of sulphuric acid, and it must not be forgotten that considerable amounts of sulphuric acid are made from sulphur recovered at gas works.

In addition to elementary sulphur and metallic sulphides, which may be burnt to sulphur dioxide, several sulphates occur naturally in large quantities. Of these, calcium sulphate is widely distributed as selenite and anhydrite. At sufficiently high temperatures, calcium sulphate is dissociated, and the escaping sulphur dioxide and oxygen may be used for the manufacture of sulphuric acid. The process was tried in Germany during the war, but the wear and tear to plant entailed by roasting seem to preclude any economic use being made of a process depending on the dissociation of calcium sulphate.

We thus see that our most important chemical compound depends for its production on a supply of sulphur or a metallic sulphide, with a possibility that sulphates may find employment at a later date. With regard to sulphur itself, distribution is very limited, and we in Britain must go outside for it. As to metallic sulphides, the only one likely to be adopted on

the large scale where sulphuric acid is the primary object of manufacture, is iron pyrites, or other pyrites, which, in addition to iron, contains copper and other metals in varying amounts sufficient to pay for their extraction.

Whilst dissociation of naturally occurring sulphates by heat is unlikely to be of use technically, one may remember that the sulphates of the alkali earth metals exist in enormous quantities in most countries, and they may be readily reduced. The suggestion has recently been made to reduce gypsum by methane in order to obtain sulphur; whether such a process will be exploited in Germany remains to be seen.

Alkalis

Turning next to alkalis, the greatest amount of sodium carbonate and caustic soda are obtained from sodium chloride; our supply of raw material, whether brine, limestone or fuel, is assured in this country. Natural sources of sodium carbonate are also known; the Magadi soda deposits may be mentioned in this connection. Ashes of seaweed as an important source of supply may be disregarded, and it is fairly certain that common salt will continue to be the raw material from which other sodium compounds are manufactured.

In the case of potash we encounter a very different problem as to sources of supply. Practically every country is able to produce sodium chloride; it may be as rock salt or from brine springs, or, failing either, sea-water is available.

In the case of potash, the old sources from the ashes of plants and molasses and the washing of fleeces would be next to useless for the present world's consumption of roughly 1,000,000 tons per annum. Potash exists in considerable amounts in igneous rocks, the amount contained in British granite must be enormous, but is not accessible. Some potash may be recovered from the dust of blast furnaces; it is doubtful whether such an industry could survive free competition.

Potash Salts

When we turn to soluble potash salts, we find that sylvine, carnallite, kainite, etc., are not widely distributed, but that enormous deposits are found in certain isolated localities. Of these, the Stassfurt deposits of North Germany are the most celebrated, whilst following them in importance are those of Alsace. Two or three years ago something was heard of potash deposits in Eritrea, though Italians have recently turned their attention more to sources of potash on their own mainland.

Professor Hinchley recently drew attention to the production of potash which is now being effected from Italian leucite. The lavas of Italy are estimated to contain over 8,000,000,000 tons of potash (as K_2O) and Professor Hinchley believes the world's potash demands for 500 years could be met from lavas which are visible and available. Pure leucite is $K_2O \cdot Al_2O_3 \cdot 4SiO_2$ (K_2O , 21.5 per cent.; Al_2O_3 , 23.5 per cent.; SiO_2 , 55 per cent.), and differs from felspar in being directly attacked by acids; further, if granular leucite is employed, the silica is left as a skeleton occupying about the same volume as the leucite operated on; the bugbear of gelatinous silica is thus avoided. At the present time leucite is being used in the neighbourhood of Lyons for the preparation of potash alum. It may be noted that the leucite has the potash and alumina in the correct ratio.

Another process has also been worked at Cengio by Baron Blanc and Felix Jourdan, the decomposition of the leucite being effected by hydrochloric acid. The products which may be obtained after such decomposition are potassium chloride and either hydrated aluminium chloride or aluminium hydroxide as well as silica. It appears to be feasible to decompose the leucite with lime and water under pressure, and thus obtain a solution of caustic potash directly.

Ammonia and Ammonium Salts

When we consider ammonia and ammonium salts we are able to manufacture enough in this country for our own needs (in time of peace) and have a considerable surplus for export. The production of ammonium sulphate in this country was 50 per cent. greater in 1922-23 than in 1921-22, and this must

* Abstract of a paper read before the Northern Polytechnic Institute Chemical Association, Sir Robert Robertson in the chair.

have been manufactured almost entirely from liquors derived from gasworks and coke-ovens. The war had a good effect on the coking industry in that the use of recovery plant became more general.

We may note here that the distillation of coal gives us our present supply of cyanides as well as ammonia, though increasing quantities of the latter will be obtained by synthesis from atmospheric nitrogen.

There are other nitrogenous compounds which must be taken into account, especially the nitrates and nitrites.

Originally, nitric acid was obtained from nitre, potassium nitrate, the collection of which was a matter of considerable moment. For roughly a century, Chile saltpetre or sodium nitrate has been the chief source of nitric acid and also of nitrites. During the war, one of the chief anxieties with regard to the supply of explosives was with regard to the importation of nitrate as affected by the submarine danger. Whilst countries with a plentiful supply of cheap water power can obtain their supply of nitrates and nitrites from the air by the direct union of nitrogen and oxygen at the temperature of the electric arc, a process of this nature has no promise of success in Britain. Synthesis is not excluded, for we may synthesise ammonia from nitrogen and hydrogen—an exothermic process—and subsequently oxidise the ammonia to oxides of nitrogen, and so obtain nitric acid, nitrates and nitrites. It is scarcely necessary to point out that ammonia as obtained by the distillation of coal may also be used.

Turning from the generally used acids and alkalis to compounds employed for oxidation and kindred purposes, we first encounter chlorine. Our supply is ultimately derived from common salt, whether we first produce hydrochloric acid and then oxidise this by means of manganese di-oxide or air, as in the Deacon process, or, alternatively, work by direct electrolysis of brine, so obtaining chlorine and caustic soda as products.

Reducing Agents

Amongst reducing agents as used in the production of common bases such as aniline, iron is of prime importance. We further have to take sulphites and hydrosulphites into account, as well as zinc dust. The production of sulphites and hydrosulphites depends ultimately on the burning of sulphur or a metallic sulphide. As to zinc, whether massive or dust, the supply of English ore is now insufficient for requirements, but the Empire should be in a position to supply all we want.

Only brief reference can be made to compounds of the other non-metallic elements. Borates are chiefly of foreign origin, the British Empire seems to have largely avoided the volcanic districts of the earth.

Elementary phosphorus and other phosphorus compounds must be obtained from naturally occurring phosphates, and these, for the greater part, are obtained either from America or North Africa. The other non-metallic elements of the fifth group, arsenic, occurs in considerable amount associated with other ores in this country and a fair amount is recovered.

Selenium and tellurium hardly concern the heavy chemical manufacturer, but the former is employed to some extent in medicine and with the increasing supplies, other uses may be found for this element and its compounds.

Fluorine compounds are obtained for the most part from fluorspar, of which, I suppose, we have a sufficient supply for our own requirements. Bromine, though first discovered in sea water, is usually obtained from the mother liquors left after crystallising potassium chloride. This was practically a German monopoly, and I expect we still obtain the greater amount from that country, though the United States have become considerable producers of late years. Though iodine is so widely distributed, we are practically in the hands of the South American producers of sodium nitrate. Although the aggregate amount of iodine contained in the sea must be enormous the quantity is so small relatively to the other salts that concentration is not practicable with the means at our disposal. Concentration does occur naturally with sea-weed and kelp may be used for the preparation of iodine, but it seems improbable that it will ever be used to any extent as a source of supply.

The raw materials for the organic chemical industry are of a very varied character and to attempt a classification into heavy and fine chemicals would be most unprofitable for a scientific chemist, though it might appeal somewhat more to

a manufacturer or dealer and prove a source of real delight and profit to a lawyer. I think my best way will be to see how far we can get in preparing useful organic compounds from carbon itself and then pass on to natural sources of supply.

Carbon will combine directly with hydrogen at a high temperature producing methane, methane is also a natural product. Probably the synthesis of methane commercially is impracticable, but with natural methane in abundance, a number of reactions might be carried out with a chance of commercial profit. By chlorination we can get methyl chloride and by hydrolysis of the latter, methyl alcohol. From the methyl alcohol it is only a step to formaldehyde, one of the most important compounds from a synthetic standpoint.

Another simple compound is carbon monoxide, its union with chlorine furnishes phosgene, useful for making a number of derivatives. Further, carbon monoxide combines with alkalis under suitable conditions of temperature and pressure to give formates, whilst loss of hydrogen by the latter leads directly to synthetic oxalates. These reactions starting with carbon monoxide are actually worked commercially.

Another synthetic route from carbon is by way of the carbides. Calcium carbide reacts with nitrogen giving calcium cyanamide, so opening the way to guanidine and other compounds. On decomposition with water, calcium carbide furnishes acetylene, which, under the influence of mercury salt catalysts unites with water to form acetaldehyde. The latter may be oxidised to acetic acid from which we may prepare acetone or the aldehyde may be made to give ethyl acetate directly by employing a suitable catalyst. A more recent development is the regulated oxidation of acetylene with the production of formaldehyde, how far commercial success will attend such reactions is still unknown.

We thus see that organic compounds containing one or two carbon atoms per molecule are likely to be produced in increasing quantities by synthetic means.

Synthetics Products

There are many cases where synthetic materials are unlikely to compete in the near future with natural products; we have only to remember the case of rubber. Even with simple carbon compounds, we generally fall back on natural organic materials for our supplies. Though we can synthesise methyl alcohol and acetic acid, our chief source of these products is the distillation of wood. It is to be hoped that synthetic processes may be successful in eliminating wood distillation as an extensive industry.

Amongst carbon compounds with two atoms of carbon per molecule, ethyl alcohol is probably the most important from the chemists' point of view. Fermentation looks as if it would hold its own, it is interesting to know that for the production of alcohol from the Jerusalem artichoke may be a serious competitor of the more frequently used potato. From starch we may also proceed to butyl alcohol (and still higher alcohols) as well as acetone and butyric acid.

Of carbon compounds with a chain of three carbon atoms, mention must be made of glycerine. The soap manufacturer needs the fatty acids so that glycerine is likely to continue to be produced by the hydrolysis of fats. And there is a further reason why this is likely, so far the organic chemist has proved a poor competitor to either the oil palm or the pig. Our supplies of vegetable fats come chiefly from British Possessions, but it would be advisable to consider cultivation more closely. Our Dutch friends have tried cultivation of the Palm-Oil and succeeded in producing better palm kernels in the Dutch East Indies than those collected on the West Coast of Africa.

Now as to hydrocarbons. The paraffins and cyclo-paraffins are almost entirely used as fuel, a certain amount goes for solvent and hardly any for conversion into other compounds. The possibility of oxidising higher paraffins to fatty acids is a question which is raised periodically, so far nothing has been done on an extensive scale commercially.

The paraffins and cycloparaffins are usually obtained from native petroleum, a certain amount is produced by the distillation of shale. Scottish shale yields members of the paraffin series on distillation and these are also formed in the low temperature distillation of coal. Whilst oil wells are likely to contribute the greater quantity of paraffins, one may obtain saturated hydrocarbons in quantity from coal by heating in hydrogen at very high pressures as in the process of Bergius. Many shales yield unsaturated hydrocarbons

(olefines and diolefines) and organic sulphur compounds on distillation, from the point of view of fuel, these must be considered an unmitigated nuisance.

The chief source of aromatic hydrocarbons is the tar from gasworks and coke-ovens. Additionally, aromatic hydrocarbons are found in nature; thus, in some of the East Asiatic petroleum, aromatic hydrocarbons form a considerable percentage of the whole. This proved of great value during the war, much of the T.N.T. used having been derived from toluene contained in such oils.

The distillation of coal is likely to remain the chief source of aromatic compounds, of substances obtained from coal-tar, the following may be specially mentioned: Benzene, toluene,

xylene, naphthalene, anthracene, pyridine, carbazole, phenol, the cresols.

The chemical manufacturer also depends on a number of natural products which have hitherto not been synthesised or whose synthesis would be unprofitable. This is particularly noticeable in the case of drugs—take for example digitalis products, eucalyptus, the alkaloids of opium and cinchona, camphor, etc.

These are obtained from plants, many of which are, or might be, grown within the British Empire. It would be out of place to discuss the protection of industries in a meeting of this description, but I think we may all agree as good Britons that considering the extent of the Empire, it is a duty to look for sources of all materials which may be of use within its borders.

Chemistry in Relation to Public Life

Suggestions for Co-operative Action

A MEETING of the Manchester Section of the Institute of Chemistry was held on Monday evening at the Textile Institute, Manchester, when Mr. F. E. Hamer (editor of THE CHEMICAL AGE) read a paper on "The Chemist in Relation to Public Life." Mr. S. E. Mellings, F.I.C., presided, and there was a large attendance both of members of the Institute and of the Manchester Section of the Society of Dyers and Colourists.

The CHAIRMAN, in opening the proceedings, said that Mr. Hamer was no stranger to Manchester, having been formerly engaged in journalistic pursuits and other public work in the city. It was said that the looker-on saw most of the game, and this was particularly true of Mr. Hamer, who, for some years past, had been making himself thoroughly well acquainted with the general outlook in regard to chemical industry not only in this country but abroad. It was a great advantage to have a paper from a gentleman who could give them a wide survey of the whole situation as it related to the chemist and public life.

A Change in Chemical Mentality

In the course of his paper Mr. HAMER said that the modern demand for greater publicity for chemistry indicated a certain change in chemical mentality, but it was necessary to remember that research work must always be done in the background, and that, in point of conditions and temperament, the research worker was not adapted to the limelight. Yet the work done by chemists was work of which the public ought to know more than they did, for it lay very near the basis of all our industrial success, and the question arose how the one world was to be interpreted to the other. Before considering any positive steps they might perhaps agree on one negative point. If they could not actively help the diffusion of knowledge about chemistry they could at least refrain from deliberately keeping the public in ignorance of it. Mathew Arnold's dictum that if the people would not come to the schools the schools must be taken to the people was now accepted in education, and if they could not bring the nation to the knowledge of chemistry they must take a knowledge of chemistry to the nation. If, as Professor W. P. Wynne stated recently, what was wanted was a campaign of publicity, and chemists had to interpret themselves to an unbelieving country, it was obvious that one of the instruments was a fuller and better informed use of the Press which the public read.

After an account of conditions in America and of the public work which the American Chemical Society had organised for making chemistry better known, Mr. Hamer said that, assuming it to be recognised that chemistry needed a fuller interpretation to the public, it only remained to suggest some possible methods.

The Need of Leaders

Among the necessary conditions (he said) I should place first in order though not necessarily in importance the need of public-spirited leaders. Every public interest depends largely for its influence upon its personalities, men who happen to be big public figures, and whose words command the public ear. It is an accidental advantage or disadvantage which cannot be controlled, but it counts for a great deal. Take the case of Darwin, whose patient researches were suddenly found to

have a profound effect on the religious thought of his time. His theory of evolution, challenging, as the orthodox religious teachers of his day held, the whole basis of revelation, was discussed in every paper, in every pulpit, on almost every platform, until it became a household word throughout the land. In that casual and quite unpremeditated way science got one of the most tremendous advertisements it ever had. And it was sustained by men like Huxley and other brilliant essayists and tractarians, whose words and ideas vividly touched the current thought of their time. Have we to-day any one great chemist who commands in anything like that sense and degree the ear of the entire nation, not merely *qua* chemist but as a great national figure? You who happen to be hero-worshippers may trot out your favourites, but I cannot think of one quite in that class. But there is a sufficient group of chemical leaders to supply real leadership, if they will. In addition there is behind them a great body of chemists quite capable, if they care to exert themselves, of interpreting themselves and their science to the public. It is fashionable in some quarters to think of the chemist as a wizened applejohn type of person, immersed in his own mysterious lingo and apparatus, and little concerned with wider human interests. If that be true at all it is much truer of the older generation than of the new. Again and again I have been surprised at the facility with which so many chemists, largely of the research class, engaged in the most intensive and abstruse studies, are able to expound in matchless English the results of their work and its bearing on life. I cannot believe that at any time the power of literary expression and of vision among the younger race of chemists was greater or more general than it is to-day, and the profession has in this a great instrument at its service.

Relations with the Press

If it is to be turned to account in influencing public opinion, one of the avenues of influence must naturally be the Press, and this is being already used to an increasing extent. Many of the leading dailies now publish regular contributions, not of the cheap and popular type, but seriously discussing problems of high scientific interest. This is a proof both that the public interest can be touched and that the chemical mind is very far from incapable of expressing itself, when it really tries, in a way the intelligent though non-technical public can understand.

A few days ago I got an official communication from the American Chemical Society calling attention to columns of space given up in the *New York Times* to lectures on the Atom delivered by a Yale professor, and the Society in this communication, in expressing satisfaction at the more intelligent public interest in chemical developments, adds: "In the meantime we ought to give all possible encouragement and assistance individually and through our respective local sections to the newspapers and their reporters in producing accurate and impartial accounts of chemical and other scientific topics." In plain words, the American Society has recognised that you cannot educate the public through official publications; these are for home consumption, and for the export of knowledge you must employ all the outside distributing agencies at your service.

Secondly, there is the combination and co-operation of chemical and allied societies both at headquarters and locally. Combination of this character, if it is inspired by purely selfish ends and intended merely for the domestic good of the bodies taking part in it, is not likely to produce much effect upon the public mind; but if used unselfishly with a sincere desire to advance the reputation and influence of chemistry among the community in general it might prove to be an immense gain. In a great commercial and industrial community like this, where chemical interests are so closely mixed up with public utility services—food, lighting, housing, gas, water, and even beer—one can readily imagine problems arising on which the collective judgment of a joint committee of chemical experts might be of great public value in the instruction and guidance of public opinion. In America, such committees exist and are said to be doing excellent work.

Chemical Interests in Parliament

Thirdly, there is the familiar question of direct chemical representation in Parliament. If this means that chemists are to seek election simply because they are chemists and to regard that as their first concern in the House of Commons, I should say the policy would be undoubtedly bad, because Parliament represents in a collective sense the total citizenship of the nation and cannot be constituted on a sort of molecular basis. But the incidental advantage of the presence of eminent representatives of chemical science and chemical industry must always be great. In Sir Alfred Mond chemical industry and indeed the nation has lost a very able statesman, especially on finance and business, but compensation may be found in the return to Parliament of Sir John Brunner, in the re-election of a distinguished scientist like Dr. Clayton of Widnes, in the choice by Glasgow of Sir William Alexander as the successor of Mr. Bonar Law, and considering how things have gone it seems probable that the group might have included also Sir Max Muspratt, if he had stood. Without entrenching on party politics one may venture to say that chemistry is the stronger on its public side for the presence of such representatives in the House, and there is no reason why, differing as they inevitably do on ordinary political issues, they might still not constitute themselves into some kind of consultative or advisory body on matters of technical and commercial interest, in which case we should at least have the interesting spectacle of the manufacturer showing up the unfair profits of the merchant, of the merchant showing up the rapacity of the manufacturer, and of the technical man convincing both that neither of them knows what he is talking about. In matters of this kind it would often be of incalculable value to Government Ministers and to the heads of departments occasionally to be able to have a body of expert opinion on whose impartiality they could rely. The advantages of having a good spokesman whose words command the attention of responsible people in the Government could not have been better shown than in the case of the late Lord Moulton who came, as the result of his war work, to be recognised as the authoritative spokesman for chemical industry.

A Central Clearing House.

A fourth suggestion is that something might be done to establish some sort of clearing house for the purpose of giving information and advice to persons who have inquiries to make. The absence of this is very much noticed by strangers who come to this country for the first time and are anxious to get into touch with scientific or commercial interests. Again and again people have called upon me—in one case an assistant director of industries of an Indian State, in another a big commercial man interested in colloidal research respecting clay, in another a couple of American students desiring to know how they might best spend a period of 12 months of residence in this country; in yet another, American correspondents who came over here to inquire into the economic and scientific conditions of chemical industry—desiring to be put in touch with people who could assist them with such inquiries. Such people come to me as strangers, and I try not to take them in, but generally the only place I can think of in such cases, apart from reference to individuals, is the A.B.C.M. This in a very short time has been built up into an organisation which takes a wide and liberal view of its duties, and Mr. Woolcock has already partly created a general clearing house which is proving of immense value to many interests outside his own membership. I think it is safe to

repeat what I ventured to say elsewhere, that wherever the centre of gravity for chemical industry was formerly, if it ever had a centre, it is now definitely located at 166, Piccadilly. But more yet remains to be done to complete the organisation for making accessible the general facts about the chemical profession and industry of this country and to provide what would in fact be a central clearing house of knowledge.

My fifth suggestion is that more might be done to encourage young chemists to extend the range of their outside interests, not to be less of chemists, but to be more of citizens, not merely to be content with their own research and discovery, but to follow it through the stages of commercial production and to see finally its uses for the general community. The temptation to the chemist to slip into his own little groove and remain there is too obvious to be pointed out, but his own interests, I am convinced, lie in a much wider extension of his mental and social interests, both for his own good and for the good of chemistry as a whole. Quite recently I heard Sir A. Duckham plead very seriously that the chemical man should learn the art of speaking with engineers and other outside interests and preparing reports for commercial men in terms that the non-technical man would be able to understand. And I have even heard a distinguished engineer offer this explanation of the reason why the engineer so often, and the chemist so rarely, is the man selected to take charge of the works. While the chemist spends his time in the laboratory largely isolated from other workers the engineer goes through the shops, gets acquainted with the workers, and enriches his vocabulary. In that way he fits himself for handling men and handling business.

Chemists and Industry

Sixthly, greater attention might be paid to the organisation of industry and the employment of chemists in its development. One of the problems confronting the industry to-day is the rather large number of qualified chemists who are unemployed, and the difficulty which young men on the completion of their educational career find in obtaining posts in industry. I cannot believe that industry has already absorbed the full number of chemists that it is capable of profitably absorbing, and if manufacturers who employ small staffs where they should employ large, or who employ none at all where they should certainly have some chemists at work, are to be educated out of their present unappreciative attitude, their education can only be undertaken by chemists themselves. It is interesting to notice in the current issue of the *Gas World*, an advertisement by the Gas Light and Coke Co. for the services of an experienced chemist at their chief office to advise on chemical problems relating to the carbonisation of coal and to direct research in connection therewith, and to control a research laboratory at the company's chief office. This company, I believe, is the largest in the world, producing 35,000 million cubic feet of gas per annum, and having 900,000 gas consumers. The fact that it has decided on a more definite research organisation indicates the commercial value which progressive concerns recognise in chemistry, and suggests that there is still considerable room, not already filled, in industry for the profitable employment of the chemist. At present, so far as I know, there is no body which gives specific attention to this problem of educating the manufacturer, and in this matter something might surely be done by organising conferences of commercial bodies such, for example, as the Federation of British Industries, or Chambers of Commerce and organisations of that kind, at which representative chemists who really know something about the results of the application of chemical science to industry might put the case before the employing class and in that way enlarge the scope for chemical employment.

Lastly, there is the part which chemists themselves can take in safeguarding the status of the profession, and in this connection one may very justly pay tribute to the great work which the Institute has done in establishing a recognised academic standard for the professional chemist, in gradually building up a standard of professional practice and etiquette, and in taking opportunity as it arises of seeing that the conditions and salaries of employed professional chemists are raised to a level corresponding to the cost of their education and the value and responsible character of their services.

I have ventured as a layman speaking to experts to suggest some ways by which the public influence of chemistry may be enlarged, its services made better known in industry and the individual chemist professionally helped and recognised. Much has been done in these directions already, but much yet remains. I believe, however, that steady progress is being made, and that, if all members of the profession work loyally together, if the organised chemical bodies forget their domestic rivalries in a desire for the common good, if profession and industry come to learn that fundamentally they are one, if all interested work for unity and against division, for progress and against reaction, for initiative and against inertia—if these things are done I believe that the chemist is bound to come ultimately into his rightful inheritance, and that the profession and the industry of chemistry will receive the public recognition and gratitude which their services to mankind deserve. (Applause)

The Discussion

The CHAIRMAN wished to refer to the seventh point mentioned by Mr. Hamer, where he concentrated as it were on the individuality of the chemists and what the chemist himself had to do. The Institute had, in its wisdom, established local sections, and the subjects which were suggested for discussion were not those which would in any way fall foul or interfere with the subjects put forward by the Society of Chemical Industry or the Society of Dyers and Colourists, but were to be of a broad type of character. In the subject-matter of Mr. Hamer's paper there was much food for general thought.

Mr. J. H. LESTER, in proposing a vote of thanks, said the address was undoubtedly one they would all remember for a very long time to come. It had been exceptionally racy, invigorating, and suggestive from beginning to end. He thought there should be a full discussion on the question of publicity as raised in it. Mr. Hamer had made out an excellent case and there was undoubtedly a good deal of evidence to support his side of the argument. Personally, he was by no means convinced it would be altogether for the benefit of the chemist to go to the full length of publicity which was customary in the United States. He did not know very much about what had been done in the United States with regard to many sections of chemical industry, but so far as textile chemistry was concerned he was inclined to think that publicity there had gone far enough. Mr. Hamer had been careful to distinguish between the popular type of chemical matter and substantial technical and scientific articles. Publication of the latter would undoubtedly be of benefit to a great many. Mr. Hamer had referred to the Chemists' Club in New York. He understood it was a club which had been spoken of as being the finest club in New York, but he also believed it was occasionally spoken of as having very little to do with chemists. He thought we had more or less of a parallel in the Automobile Club in London, where the automobile interest seemed to matter very little. He hoped that the governing bodies of British chemical clubs would see to it that those institutions were used primarily for the benefit of chemists. As Mr. Hamer had pointed out, it did not by any means follow that a man who wanted certain chemical data should be able to go to a Bureau of Information and obtain it on the spot; what he frequently wanted from such a bureau was advice as to where to go for the purpose of satisfying his requirements. It was obviously impossible for such a broad subject as chemistry in its pure and applied sides to be dealt with exhaustively by merely one centre of information; there must be a certain amount of decentralisation. The sooner chemists succeeded in worming their way into the inside of the works with which they were connected, and understanding thoroughly the processes carried on, the sooner would they be appointed to managerial positions. The chemist who simply remained in the laboratory would continue to be more or less unrecognised from the organising and purely business point of view.

Dr. ARDERN, in seconding, said Mr. Hamer had made a very brilliant survey of his subject, and he, personally, could corroborate all that had been said by him with regard to chemical affairs and chemical knowledge in the United States. There was no doubt that in the United States chemistry received a better national treatment than it did in this country. Whatever information was required there was

always some bureau in some part of the United States which could supply it, whether it was a question of water purification, metallurgy, atmospheric pollution, or anything else. Every American official was most anxious to put an inquirer on the right track. While they were all agreed with Mr. Hamer that chemists did require a much better public platform, nevertheless such difficulties as Mr. Lester had hinted at must be guarded against. Everything depended upon the *esprit de corps* of chemists themselves if they were to make any real advancement in the status of the profession.

Society of Public Analysts

At the ordinary meeting held at the Chemical Society's rooms, Burlington House, London, on Wednesday, December 5 (Mr. P. A. Ellis Richards, President, in the chair), certificates were read for the first time in favour of:—Messrs F. Knowles, A. Knox, A.I.C., C. R. Middleton, B.Sc., A.R.C.S., D.I.C., A.I.C., H. R. Read, A.I.C., G. Hogan, F.I.C., and T. F. Doyle. Certificates were read for the second time in favour of:—Messrs. R. C. Frederick and H. T. S. Britton, M.Sc.(Lond.), F.I.C.

The following were elected Members of the Society:—Messrs. L. E. Campbell, M.Sc.(Lond.), F.I.C., J. T. Hannen, B.A. (Cantab.), A.R.C.S., A.I.C., C. L. Hinton, F.I.C., D. W. Kent-Jones, B.Sc. (Lond.), F.I.C., T. W. A. Shaw, M.Sc. (Liv.), W. H. Simmons, A.I.C., K. E. N. Williams, and P. N. Williams, M.Sc. (Liv.), A.I.C.

Abstracts of Papers

"The Crystalline Bromides of Linseed Oil" was the subject of a paper by Harold Toms, M.Sc., A.I.C. It was pointed out that the "insoluble bromide" of linseed oil, first described by Hehner and Mitchell, appeared to consist of mixtures in varying proportions of two crystalline bromides, viz.: (1) a linolic-dilinolenic bromo-glyceride, and (2) the trilinolic bromo-glyceride or the oleic-linolic-linolenic bromo-glyceride. These two bromo-glycerides had been obtained in pure condition by crystallisation from ethyl acetate. They melted at 153° C. (corr.) and 117° C. (corr.), respectively. The solubility of the more insoluble bromide in ethyl acetate lay between 0.15 and 0.20 gm. per 100 cc. at 15 to 20° C. The methods of estimating the bromide in these compounds had been studied, and it was shown that theoretical results could be obtained by the method of Carius and by a modification of the method of Stephanow, but not by the lime method. Various methods of estimating the more insoluble crystalline bromides were described, the yields of the purest product varying from 9.39 to 11.6 per cent. in the case of different oils. The results obtained suggested that there was some relationship between the yield of this crystalline bromide and the iodine value of the original oil.

M. S. Salamon, B.Sc., in a paper on "The Plea for Standardisation," emphasised the fact that in every field of analytical chemistry instances were continually occurring where different, although well recognised, methods of analysis yielded varying results. He referred in particular to the case of dried milks, and instanced one example where one sample of dried milk was sent to four well-known analysts, and a considerable divergence of figures resulted according to the methods used, particularly in the case of the fat and lactose estimations. Referring next to essential oils, the need for standardisation was seen to be urgent, for in many cases minute modifications in detail caused substantial differences in results. The same remarks applied to the case of inorganic materials of simpler composition, and the author saw a recognition of the difficulties in the details laid down for analyses under the Fertilisers and Feeding Stuffs Act, and he strongly advocated the formation of a committee to consider the whole question.

In "A Note on the Estimation of Chromium," by Hubert T. S. Britton, M.Sc., F.I.C., the gravimetric methods of estimating chromium as oxide were discussed. Whatever precautions were taken to use only the purest reagents and salts and platinum crucibles, the ignited oxide was always found to contain some chromate. This might be shown by extracting with water. Hence such methods led to high results. It had been found that chromium could be quickly and accurately estimated volumetrically. The procedure was to add to an approximately neutral solution of a chromium salt an excess of sodium peroxide—about a gram—and boil for ten minutes

to complete the oxidation to chromate and to decompose the unused peroxide. After acidification with either sulphuric or hydrochloric acid, excess of potassium iodide was added and the liberated iodine titrated in the usual way.

A paper by R. L. Andrew dealt with "The Colorimetric Estimation of Lead in Cream of Tartar." During 1921-22 all importations of cream of tartar to New Zealand were examined for lead, and the following method was found to give similar results and to be less cumbersome than the B.P. method. One cc. of 5 per cent. potassium cyanide solution, 1 cc. of ammonia solution, and 40 cc. of water were added to 2 grams of cream of tartar, and solution effected by warming and shaking. After cooling and filtering, any tint was matched in the standards by the addition of very dilute caramel. These standards were prepared in a similar way from 2 grams of lead free from cream of tartar, with the addition of requisite amounts of lead nitrate solution containing 0.01 per cent. of lead. A few drops of 10 per cent. sodium sulphide solution were added and the solutions were all made up to the mark and the amount of lead estimated by comparison. If a standard water solution of lead was used a serious error was introduced, as the colour was only about half the depth of that produced with a tartrate solution, and the effect of ferric and ferrous iron was investigated.

From Week to Week

MR. H. J. GEORGE has been elected an Official Fellow in chemistry of Jesus College, Cambridge.

IT IS ANNOUNCED that 13,000,000 francs (more than £160,000) was collected for the benefit of French scientific laboratories on the occasion of "Pasteur Day."

MR. J. ROBERTS, lecturer in the chemistry department of the University of Glasgow, recently received an honorary degree of Master of Arts from the University.

AT A MEETING of the Institution of Petroleum Technologists in London on Tuesday, Mr. L. R. McCollum, a non-member, read a paper on "The Modern Rotary Drilling System."

THE FORMAL PRESENTATION of the Nobel prizes took place at Stockholm on Monday, the anniversary of the death of the donor, the award for chemistry going to Dr. Pregl, of Graz.

A MEMORIAL BUST of Professor August Sheridan Delepine, founder and first director of the Public Health Laboratory, Professor of Pathology 1891-1904, Professor of Public Health and Bacteriology 1904-1921, was unveiled in the University of Manchester on Wednesday.

A MEMORIAL WINDOW to the employees of the South Metropolitan Gas Company who fell in the war, 386 in number, was formally unveiled in Southwark Cathedral on Saturday afternoon at a service attended by directors, officials, and men of the company and relatives of the fallen.

DR. ALEXANDER SCOTT, F.R.S., the director of Scientific Research, who will be remembered in connection with the recent Hafnium controversy, has arrived in Egypt to assist in the problems arising from the preservation of objects removed from the recently reopened tomb of Tutankamen.

IN OXFORD CONVOCATION a decree has been approved authorising the Curators of the University Chest to pay from the Government grant by terminal instalments the sum of £600 to the laboratory fund of Balliol and Trinity College for teaching physical chemistry on behalf of the University.

THE DISPOSAL and Liquidation Commission has definitely decided to realise by public auction in the spring the whole of the real estate of the Gretna Munitions Factory. The total area extends to over 3,000 acres, and the property includes two Government townships.

THE SCHEME propounded by the Federation of British Industries for instructing the public on national industries by means of the cinema is said to be making good progress. Films have already been completed dealing with coal and coke products, heavy chemicals, iron and steel, etc.

AN OUTBREAK OF FIRE, which resulted in slight injuries to two workgirls, broke out on Friday, November 30, at the premises of Cadby and Sons, Ltd., electro-platers and polishers, 20 to 26, Barr Street, Hockley. The lacquering room was burnt out, and a certain amount of work in hand was destroyed, the damage being estimated at several hundred pounds.

THE APPEAL of the Standard Oil Company, of New York, from a decision of the Court of Session in Scotland in the company's claim against the Clan Line Steamers, Ltd., Glasgow, for £111,235 damages for loss of cargo shipped on board the steamship *Clan Gordon*, which turned turtle and sank when two days out of New York on a voyage to China, has been allowed by the House of Lords.

A CURIOUS CASE of chlorine gas poisoning occurred to a workman on Saturday, December 8, while following his employment at the works of Tennants, Ltd., chemical manufacturers, Clayton, Manchester. The man was engaged in washing a carboy when the wind blew the gas into his face and he was overcome. He was removed in an unconscious condition to the Manchester Royal Infirmary, where he was detained.

PRESIDENT COOLIDGE is said to be in favour of the U.S. Government building a steam power plant in connection with the Muscle Shoals project to attract a new bid from Henry Ford for the Alabama water power development. The President regards the production of large quantities of nitrate through fixation of nitrogen as an outstanding national need, both from the military and agricultural standpoints, and he thinks that this need is so important that the Government would be justified in taking over the Muscle Shoals project even if it was operated at a loss.

AN ARTICLE by the Medical Correspondent, which appeared in *The Times Trade and Engineering Supplement* of December 1, on "Health and Work," refers to the valuable results obtained from classes on technical subjects in connection with the Industrial Welfare Movement for the workers in an industry which depends for its success on an application of chemical science. The employees thus gain a knowledge of the industry which they would otherwise lack, leading to a better relationship between them and their employers and a reduction in labour troubles.

AS THE RESULT of a generous request made by private friends to Lord Buckmaster, as chairman of the governing body of the Imperial College of Science and Technology, there have been offered, and accepted, two post-graduate scholarships at the College of £300 a year each for students from the universities of each of the Dominions of Canada, Australia, New Zealand, and South Africa, and of India, for the session 1924-25. The fact was revealed in correspondence between Lord Buckmaster and the Secretary of State for the Colonies, officially issued on Monday.

A MEETING of the Institute of Metals was held in Armstrong College, Newcastle, on Tuesday, Professor Louis presiding. Mr. S. G. Homfray, of Armstrong, Whitworth and Co., Ltd., read a paper on "Admiralty Gun Metal," of which, with Mr. Adams, he was joint author. The paper dealt with materials, mixtures, furnaces, melting practice, moulding and casting, tensile tests, pouring temperature, and concluded with remarks on heat treatment. "In spite of the strenuous efforts of the Institute," said Mr. Homfray, "non-ferrous nomenclature is still in a deplorable state of confusion."

THE WEST CUMBERLAND by-product coke oven industry is reported to be on the eve of new and important developments, and each of the coke owners is said to be now contemplating the expenditure of about £25,000 on the installation of a new type of washer which will enable the plant to produce coke equal to that from the East Coast. The aim of the Cumberland coke owners is to produce a coke as hard and as low in phosphorus as that of the East Coast coke. Although the latter costs 43s. and the Cumberland coke 25s. to 27s., nearly 10,000 tons of East Coast coke are sent to Cumberland and North Lancashire every week.

AT THE Ordinary Scientific Meeting of the Chemical Society in London on Thursday, papers were read on the following subjects: "The relation between the glow of phosphorus and the formation of ozone," by Mr. W. E. Downey; "The origin of mutarotation and the mechanism of isomeric change: A reply to Baker, Ingold and Thorpe," by Professor T. M. Lowry; "The action of inorganic haloids on organo-metallic compounds," by Messrs. F. Challenger and F. Pritchard; and "Organo-derivatives of bismuth, Part VII—Iodo- and nitro-derivatives of triphenylbismuthine," by Messrs. J. F. Wilkinson and F. Challenger.

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- The estimation of reducing sugars using potassium copper solutions. L. Maquenne. *Bull. Soc. Chim.*, November, 1923, pp. 1681-1692.
- ACIDS.**—Anthracene monosulphonic acids. Sulphonation of hydrocarbons in a basic or neutral medium. M. Battegay and P. Brandt. *Bull. Soc. Chim.*, November, 1923, pp. 1667-1678.
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- AMMONIA.**—Ammonia synthesis; the technique of the Casale process. *Rev. Prod. Chim.*, November 15, 1923, pp. 717-720.
- CLAYS.**—Clays. Part V. Action of heat. O. Bondouard and J. Lefranc. *Bull. Soc. Chim.*, November, 1923, pp. 1627-1640.

German

- ACIDS.**—Aromatic sulphonic acids and sulphones. H. Meyer. *Annalen*, September 29, 1923, pp. 327-350.
- Isatin-4-carboxylic acid. J. v. Braun and G. Hahn. *Ber.*, November 7, 1923, pp. 2343-2347.
- ARSENIC COMPOUNDS.**—The preparation of arsenides from arsine and metal salt solutions. A. Brukl. *Z. anorg. u. allg. Chem.*, November, 1923, pp. 236-246.
- CATALYSIS.**—A peculiar catalytic decomposition of hydroxylamine. A. Kurtenacker and R. Neusser. *Z. anorg. u. allg. Chem.*, November, 1923, pp. 310-320.
- CARBIDES.**—Calcium carbide, its formation and decomposition. O. Ruff and E. Foerster. *Z. anorg. u. allg. Chem.*, November, 1923, pp. 321-347.

Patent Literature

Abstracts of Complete Specifications

206,535. OILS, WAXES AND THE LIKE, PURIFICATION OF. The Oil Refining Improvements Co., Ltd., 175, West George Street, Glasgow, and J. J. Hood, 66, Canonbury Park South, London, N.1. Application dates, May 4 and July 22, 1922.

It is known that oils and waxes may be decolorised and deodorised by filtering them through pure ignited trihydrate of alumina, or its nearest natural analogue, high-grade bauxite. It has been found that certain oils and waxes are not purified so efficiently by high-grade bauxite as by low-grade bauxite, e.g., of the Irish type, while with other varieties of oils and waxes the reverse is the case. In other cases it is found that sulphur compounds may be eliminated from one oil but not from a similar oil by high grade bauxite, but a low grade bauxite may act in the opposite manner. It has now been found that a series of pure liquid dielectrics ranging from petroleum ether to lubricating oil, or liquids such as carbon bisulphide, carbon tetrachloride, benzol, chloroform, etc., may be freed from coloured impurity most efficiently by the highest grade of bauxite, and further that the purifying effect is greater the lower the dielectric constant of the material. For example, a larger volume of petroleum ether than kerosene may be decolorised by a given quantity of bauxite. It is also found that the efficiency of the bauxite depends on the character of the impurity to be eliminated, i.e., the higher the dielectric constant of the impurity the more readily it is absorbed by the bauxite. If the dielectric constant of the impurity is the same or less than that of the oil or wax, it cannot be eliminated by any grade of bauxite, e.g., benzol cannot be eliminated from petrol since the dielectric constants are approximately equal. If, however, the benzol is nitrated with a small amount of nitric acid, the nitro-benzol has a high dielectric constant, and is readily absorbed by low-grade bauxite. It is sometimes found that in treating oils and waxes, the low-grade bauxite is more efficient than the high-grade. This is due to the fact that the high-grade bauxite readily extracts the small quantities of olefines as well as the coloured constituents, and becomes saturated with them and therefore spent. A lower grade of bauxite allows most of the colourless olefines to pass through, but absorbs the coloured constituents of high dielectric constants.

In selecting the bauxite required, it is first necessary to determine the proportion of olefines present by a bromine absorption test. The dielectric constant of the oil fraction to be purified may be approximately inferred from its initial and final boiling points, since the boiling point and the dielectric constant increase together. The dielectric constant of the impurities may be inferred by the grade of bauxite which absorbs it most readily. The most efficient grade of bauxite for the purification may thus be determined. A higher grade than that necessary is selected, and it is degraded by small successive additions of sulphate of iron, nickel, manganese, or alkali, until the maximum decolorisation is obtained. The grade of the bauxite may be increased if required by the addition of alumina and then igniting. Oils and waxes of low elastivity (i.e., the reciprocal of the dielectric constant) may be purified by dissolving them in a medium having high elastivity, and then filtering through bauxite or ignited magnesite. Oils or waxes containing sulphur may be purified by passing air charged with chlorine or oxides of chlorine through them, and then filtering them through bauxite or ignited magnesite.

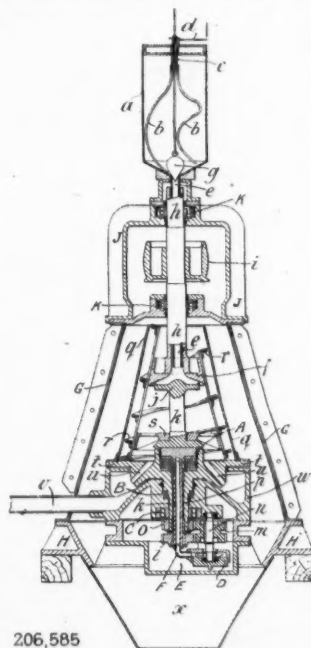
206,542. CARBONISATION OF COAL, PLANT FOR. S. R. Ainsworth, Brynfedwen, Radyr, Glamorgan. Application date, May 11, 1922.

This apparatus is suitable for use in a process such as that described in specification No. 175,888 (see THE CHEMICAL AGE, Vol. VI., p. 433), in which coal is subjected to a preliminary treatment so that it does not expand on carbonising. In this invention a long horizontal muffle furnace is provided with an endless chain driven by vertical sprocket wheels and carries a number of trays divided by partitions into compartments in which the briquettes are formed. Coal is fed into the muffle at one end, and the contents of the trays are discharged into an oven or furnace at the other end. Carboni-

sation proceeds from the sides of the coal in each compartment towards the middle, so that the outer part of each block of coal becomes heated before the centre. It is found that if the passage through the muffle occupies about one-fifth of the time necessary for complete conversion into smokeless fuel, the briquettes are sufficiently carbonised to prevent fracture in their transfer into the oven. The size of the oven should therefore be sufficient to take a charge four times as large as the muffle. The muffle is preferably heated by flues above and below. The coal may pass through a preheater arranged above the muffle, heated by waste gases from the latter.

206,572. ALKALI SILICATE SOLUTIONS, PRODUCTION OF. L. W. Codd, Winnington Hall, Northwich, Cheshire. Application date, August 5, 1922.

The usual method for producing silicate of soda by fusing sodium carbonate and sand and dissolving the product in water, does not yield a product containing more than 4 molecular parts of SiO_2 to 1 part of Na_2O . According to this invention, solutions of silicate of soda are obtained which contain from 4 to 6 parts of SiO_2 to 1 of Na_2O . A solution containing 3-3.5 parts of SiO_2 to 1 of Na_2O is subjected to electrolysis in such a manner that the desired amount of sodium is removed from the solution. The electrolysis is stopped before silicic acid is produced. The conditions of concentration, current density, and agitation are chosen so that deposition of silica is avoided, and the process is stopped when a stable water-glass is obtained which does not set to a jelly on standing. The extent of the electrolysis is limited by the fact that the final product is water-glass and not silica gel, or silicic acid hydrosol, or a silicic acid jelly containing small quantities of alkali. The sodium silicate solution is then concentrated by evaporation, and the caustic soda produced at the cathode may be recovered by any suitable means. The electrolytic cell used contains a rotating platinum anode and a mercury cathode. The solutions obtained have a viscosity concentration curve which shows a sudden bend, so that a solution having a specific gravity of 1.225 (ratio 4.2 : 1) increases in viscosity very rapidly when concentrated.



206,585. CENTRIFUGAL SEPARATORS. The Grange Iron Co., Ltd., Grange Iron Works, Durham, and H. P. Hoyle, 46, North Bailey, Durham. Application date, August 8, 1922.

The material, which may be a mixture of solid and liquid or of two liquids of different specific gravity, is fed from a hopper

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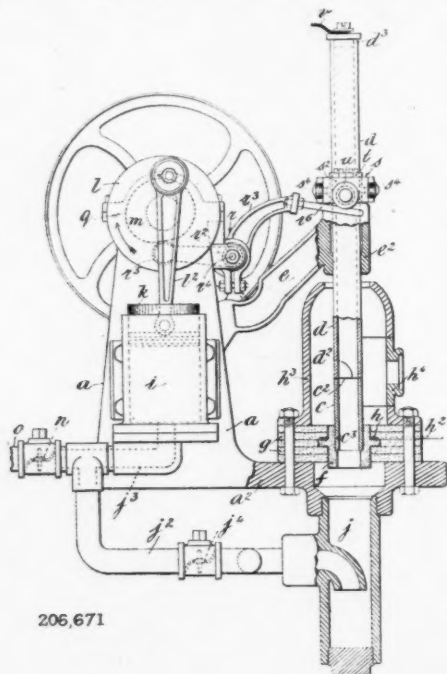
a provided with agitators *b* through a pipe *c* to the upper part *f* of the centrifugal distributor. The part *f* is carried by a sleeve *h* and is rotated by means of pulley *i*. The lower part *j* of the distributor is mounted on a shaft *k* carrying a pinion *l* gearing with a pinion *m* on another shaft. This pinion *m* also engages with a pinion *o* on a concentric shaft *p* which carries a conical vessel *q*, which is closed by a base plate *t*, having outlets *u* for the lighter material. The centrifugal distributor carries a worm *v*, which conveys the heavier material upwards and discharges it over the top of the conical vessel *q*, from which it passes to the discharge *x*. Thrust discs *A* and bearings *B* are provided for the shaft *k*, and ball bearings *C* for the shaft *p*. A small centrifugal pump *D* is provided for supplying lubricating oil. In this device the thrust on the worm *v* is balanced by the thrust on the vessel *q*. The whole is contained in a casing *G* through which the conduit *v* for the lighter material passes.

206,638. VAT COLOURING MATTERS, MANUFACTURE AND PRODUCTION OF. J. Y. Johnson, London. From Badische Anilin and Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Application date, September 16, 1922.

Derivatives of dibenzanthrone obtained by oxidation with or without an additional reduction or condensation treatment are described in specification No. 14,498/1912, and the alkylation and acylation of these products are described in specification No. 193,431 (see THE CHEMICAL AGE, Vol. VIII, p. 348). It is now found that the oxidation or reduced oxidation products of the dibenzanthrone body may be converted into vat colouring matters by treating with an aldehyde, polymerised aldehyde, or an acetal, in concentrated sulphuric acid or in indifferent solvents or diluents, with or without condensing agents. Examples are given of the treatment of the dibenzanthrone derivatives in sulphuric acid with trioxymethylene formaldehyde, methylal, paraldehyde, or anthraquinone-2-aldehyde, yielding dyestuffs of blue to red shades.

206,671. PEROXIDES OF NITROGEN, ELECTRIC APPARATUS FOR THE PRODUCTION OF. F. Stacey, Vauxhall Street, Birmingham. Application date, October 13, 1922.

The apparatus is for producing peroxide of nitrogen by passing air through an electric arc, in which two electrodes



206,671

axially in line are brought into contact and separated intermittently to form arcs. The lower electrode *c* is a vertical copper tube of about $\frac{1}{4}$ inch bore and having a flat arcing end *c*². The upper electrode is a similar tube *d* of steel which is closed at the top. The lower electrode is fixed in a con-

ducting bush *f* supported within layers of insulating material *g* and connected to the leading-in wire *h*. The lower end of the electrode *c* is connected by means of air-tight conduits *j*, *j*², *j*³ to a pump cylinder *i*, the piston of which is operated by a driving shaft *m*. The pump is adapted to drawn air through the lower electrode, and to deliver it through a conduit *o* to a receiver. The shaft *m* also carries a cam *q* which operates a lever *r*², *r*³ having a forked end *r*⁴. The device *s* is a split collar which constitutes a clutch which is adapted to lift the electrode *d* when it is moved upwards. The drawing out of the arc synchronises with the outer stroke of the piston, so that air is then drawn inwards through the arc flame into the lower electrode.

206,712. DISTILLING GAS FROM NON-COKING BITUMINOUS MATERIALS AT LOW TEMPERATURES, APPARATUS FOR.

H. Koppers, Moltkestrasse, 29, Essen-Ruhr, Germany. Application date, November 22, 1922.

When non-coking bituminous material is distilled in a cylindrical Rolle oven, the material is caused to descend along the heated walls in a thin layer by means of superimposed inclined annular slats arranged in the manner of a Venetian blind, while the gases pass through the openings into the interior. In this form, obstructions occurring in the interior of the oven cannot be removed, but the present invention avoids this difficulty by providing rectangular distillation chambers in which the slats extend along the side walls, and slightly spaced from them. The openings between the slats must be kept free of obstruction by means of continuously moving scrapers which move longitudinally along the bars. These distillation chambers are arranged adjacent to one another, with a common heating chamber between them. The air and gas for combustion are supplied to the lower end of a combustion chamber and the combustion gases pass from the top through a horizontal flue arranged above the heating space between a pair of ovens, and thence through downwardly directed nozzles into the heating chambers.

206,734. NEW INTERMEDIATE COMPOUNDS. British Dyestuffs Corporation, Ltd., 70, Spring Gardens, Manchester, and H. H. Hodgson, 136, Paley Road, Bradford. Application date, December 18, 1922.

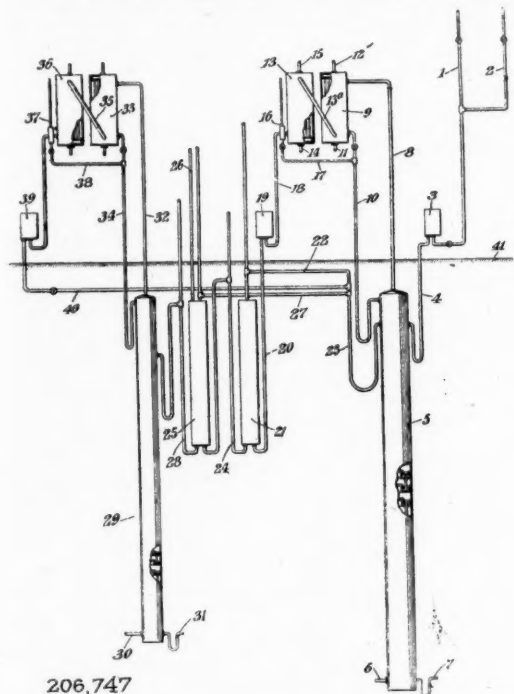
The object is to obtain paranitroso compounds of meta-halogenated phenols, i.e., metachlorophenol, metabromophenol and metaiodophenol. In an example, a solution of metachlorophenol in a mixture of caustic soda and sodium nitrite solution is cooled and sulphuric acid is added continuously while stirring. After standing for some time, para-nitroso-metachlorophenol is obtained having a melting point of 129° C. This yellow substance may be treated with hot acids, yielding a reddish substance which is regarded as the quinone oxide form. This may be treated with alkalis yielding what appears to be an isomer, which may be precipitated by acids as a pale yellow substance.

206,747. ALCOHOLS FREE FROM WATER SUCH AS ABSOLUTE ALCOHOL, PROCESS OF OBTAINING. E. C. R. Marks, London. From U.S. Industrial Alcohol Co., 27, William Street, New York. Application date, January 11, 1923.

A mixture of alcohol and water is mixed with a third liquid which is substantially immiscible with water, but miscible with alcohol, and this mixture is heated in a rectifying column, which yields water free alcohol as a residue. The third liquid may be benzol, carbon tetrachloride, hexane, etc. A mixture of alcohol and water, e.g., 95 per cent. strength is supplied by pipe 1, and benzol is supplied by a pipe 2 in such proportions that the system contains a slightly smaller quantity of benzol than of 95 per cent. alcohol. The mixture passes through a sealed pipe 4 to a rectifying column 5 of ordinary construction, into which steam is admitted at 6 to heat the column indirectly. The vapour evolved consists approximately of alcohol 74 per cent., water 19 per cent., and benzol 7 per cent., and absolute alcohol is drawn off through the outlet 7. The vapour passes through a pipe 8 to a dephlegmator 9, which is also connected by a pipe 10 at the bottom to the top plate of the column. The uncondensed vapour passes from the dephlegmator through a pipe 13 to a condenser 13, which is water-cooled, to a temperature of 64.9° C. Part of the condensate from the latter returns through pipes 17, 10, to the top of the column 5.

The main part of the condensate passes by pipes 18, 20 to a separating chamber 21, where it separates into two layers, the

upper containing approximately benzol 81 per cent., water 4 per cent., and alcohol 15 per cent., and the lower containing benzol 10 per cent., water 35 per cent., and alcohol 55 per cent. The upper layer passes through a pipe 22 back to the tower 5, and the lower through the pipe 24 to the scrubber 25. Water is added in this scrubber, and two layers are again formed, the upper of which contains all the benzol. The benzol layer passes by pipe 27 to the tower 5, and the lower



layer through a pipe 28 to a rectifying column 29 having a steam inlet pipe 30, and a draw off pipe 31 for water. The lower end of the column 29 is maintained just above 100°C. Alcohol and water vapour pass through a pipe 32 to a dephlegmator 33, from which the condensate returns to the column 29 while the vapour at a temperature of about 70°C. passes to a condenser 36, which condenses alcohol of approximately 95 per cent. strength. This alcohol is returned through a pipe 38 to the column 29, and through a pipe 40 to the column 5.

International Specifications not yet Accepted

205,477. AMMONIA SYNTHESIS. Norsk Hydro-Elektrisk Kvaestofaktieselskab, 7, Solligaten, Christiania. International Convention date, October 12, 1922.

To purify the mixture of hydrogen and nitrogen which is used in the synthesis of ammonia, the gas is passed through a solution of an alkali or alkaline earth metal (e.g., sodium) in liquid ammonia at a temperature of -20°C. and pressure of 100 atmospheres. Alternatively, a ribbon of calcium moistened with liquid ammonia may be used. The mixture of hydrogen and nitrogen is thus freed from oxygen, water vapour, carbon dioxide, carbon monoxide, etc.

205,487. INDIARUBBER MIXTURES. E. Hopkinson, 1,790, Broadway, New York. International Convention date, October 16, 1922.

Vulcanising or filling materials are emulsified or dissolved in water and then added to the rubber latex, the mixture being then freed from water. This may be done by spraying in a hot atmosphere, or in drying chambers, and a powdered product is obtained. Solid admixtures such as gums, resins, phenol-aldehydes, stearic acid, paraffins, and waxes are first dissolved in organic solvents and the solutions emulsified with water, while oils may be emulsified directly with water. Vulcanising agents such as oxybutyl-thiocarbonic acid disulphide and dibenzylamine may be similarly used. Filling materials such as carbon black, clay, wood flour, wood pulp, asbestos fibre, cotton, ground cork, etc., are treated in a colloid mill.

LATEST NOTIFICATIONS.

- 207,790. Process of hardening the products of condensation from phenols and aldehydes. Deutsch, L., Thorn, I., and "Amalith" Chemische Industrie Ges. November 30, 1922.
 207,791. Process of producing transparent, hard, insoluble, and infusible products of condensation from phenols and aldehydes. Deutsch, L., Thorn, I., and "Amalith" Chemische Industrie Ges. November 30, 1922.
 207,792. Process of producing light-coloured and colour-fast, hard, infusible, and insoluble products of condensation from phenols and aldehydes. Deutsch, L., Thorn, I., and "Amalith" Chemische Industrie Ges. November 30, 1922.
 207,830. Manufacture of hydrogen cyanide. Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler. December 2, 1922.

Specifications Accepted, with Date of Application

- 184,166. Separating dissolved substances for crystallisation, Method of and apparatus for. H. S. Marsh and R. S. Cochran. August 3, 1921.
 195,390. Charcoal, Manufacture of active. Farbenfabriken vorm. F. Bayer and Co. March 22, 1922.
 199,718. Gases and liquids, Apparatus for producing intimate mixture between. Farbenfabriken vorm. F. Bayer and Co. June 20, 1922.
 199,743. Fatty substances of animal origin, Sulphonation of. P. L. Guilleminot. June 26, 1922.
 207,224. Caustic soda from mercerised fabrics, Recovery of. E. Farrell. July 22, 1922. Addition to 197,358.
 207,247. Titanium ores, Extraction of iron and titanium compounds from. D. Gardner and L. Taverner. August 21, 1922.
 207,258. Combustible gas or gases, Process of and means for the manufacture of. C. F. Broadhead. August 22, 1922.
 207,275. Oil colours and printers' inks, Process for making. Plauson's (Parent Co.), Ltd. (H. Plauson.) August 28, 1922.
 207,276. Hydrocarbon compounds of lower boiling point from those of higher boiling point, Process and apparatus for producing. A. E. Alexander. (U.S. Gasoline Manufacturing Corporation.) August 28, 1922.
 207,337. Paper from peat, Process for the production of. Plauson's (Parent Co.), Ltd. (H. Plauson.) October 18, 1922.
 207,366. Distillation, Method of. Thermal Industrial and Chemical (T.I.C.) Research Co., Ltd., and J. S. Morgan. November 13, 1922.
 207,460. Distillation of solid materials, Apparatus for. E. Piron and V. Z. Caracristi. March 20, 1923.
 207,476. Vat dyestuffs derived from anthraquinone, Manufacture of. O. Y. Imray (Soc. of Chemical Industry in Basle). April 30, 1923. Addition to 195,753.

Applications for Patents

- Alexander A. E., and Stokes, J. S. Synthetic resins. 30805. December 7.
 Atkinson, R. G. Apparatus for chemical action under the influence of light. 30438. December 4.
 Badische Anilin- und Soda-Fabrik and Johnson, J. Y. Production of green vat dye-stuffs. 30390. December 3.
 Badische Anilin- und Soda-Fabrik and Johnson, J. Y. Dye-stuffs of the anthraquinone series. 30721. December 6.
 Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler. Manufacture of hydrogen cyanide. 30414. December 3. (Germany, December 2, 1922.)
 Durand and Huguenin Akt.-Ges. Manufacture of disazo-dyestuffs. 30838. December 7. (Germany, December 11, 1922.)
 Ewan, T. Manufacture of alkali metals. 30871, 30872, 30873, 30874. December 8.
 Ewan, T. Manufacture of alkali metal amides. 30875. December 8.
 Farbwerke vorm. Meister, Lucius, & Brüning. Process for chlorinating benzene. 30645. December 5. (Germany December 5, 1922.)
 Graue, E., and Loisy, M. C. J. E. de. Distillation. 30421. December 3. (France, January 27.)
 Guadagni, G. Manufacture of acids. 30726. December 6.
 Lichtenthaler, F. E. Process of concentrating aqueous solutions of volatile substances. 30535. December 4.
 McLean, A. Manufacture of resinous, etc., preparations. 30585. December 5. (New Zealand, January 13.)
 Pénard, W. J. Centrifugal separators. 30807. December 7.
 Soc. Chimique de la Grande Paroisse (Azote et Produits Chimiques). Purification of minerals and salts. 30825. December 7. (France, March 29.)
 Sonstagen, A. Machines for emulsifying and/or mixing liquid, etc. 30917. December 8.
 Speakman, J. D., and Sutcliffe, E. R. Agglomeration of carbonaceous, etc., substances. 30820. December 7.
 Tootal Broadhurst Lee Co., Ltd., Softening of acid-treated fabrics. 30649. December 6.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.

London, December 13, 1923.

CONSIDERING the time of the year, business has been comparatively active, and buyers are taking much more interest in the question of contracts for forward delivery. It is being generally felt that prices are now as low as they are likely to go, and that in many cases there is every chance of a rise. The prices substantially afe without change.

Export business has been only moderate, although there is a fair amount of inquiry in evidence.

General Chemicals

ACETONE is in fair request, and the price is firm.

ACID ACETIC.—Only a moderate business is reported, and the price is without change.

ACID CITRIC is steady, with a small business passing.

ACID OXALIC is steadily advancing, but the demand is small.

ACID FORMIC.—The price is extremely firm, and available supplies are eagerly sought after.

ACID LACTIC is extremely firm, with supplies very light.

ACID TARTARIC.—A moderate trade is reported. Price unchanged.

FORMALDEHYDE is firm and in moderately good request.

LEAD ACETATE is again higher, with supplies on the short side.

LIME ACETATE.—The price is fully maintained and supplies very difficult to secure for near delivery.

LITHOPONE.—The price is firm, with a moderate demand.

CARBONATE AND CAUSTIC POTASH are both higher, but the demand is small.

METHYL ALCOHOL maintains its advance, and is in short supply.

POTASSIUM PERMANGANATE fully maintains its advance, and the demand is good.

PRUSSIAN OF POTASH is unchanged in value, but business is on the light side.

SODIUM ACETATE is firm, but the demand small.

SODIUM CAUSTIC.—Price well maintained; business moderate.

SODIUM NITRITE.—A further short advance has taken place, and the product is in good demand.

PRUSSIAN OF SODA.—A fair amount of interest is now being taken on export account, although so far little business has resulted. The price seems likely to go higher in the near future.

SODIUM SULPHIDE.—The price is maintained.

Pharmaceutical Chemicals

ACID ACETYL SALICYLIC is in good demand, with very little offered.

ACID LACTIC is higher, in sympathy with the continental situation.

AMIDOPYRIN is advancing.

BROMIDES tend upwards.

CALCIUM LACTATE.—Higher prices are asked in some directions.

GUAIACOL is scarce on the spot, and is expected to advance still further.

METHYL SALICYLATE is dearer.

MERCURIALS are firm.

PHENACETIN.—The price seems likely to improve.

THEOBROMINE PURE is firmer.

VANILLIN is steady, and in better demand.

Coal Tar Intermediates

Some export inquiry continues to be received, but the general tendency is quiet in view of the approaching holidays.

ALPHA NAPHTHOL is without change in price.

ALPHA NAPHTHYLAMINE.—The demand is quiet, and there is no change in value to report.

ANILINE OIL continues to pass regularly into consumption on home account, while the export demand is firm.

ANILINE SALT.—A few export inquiries have been received.

BETA NAPHTHOL.—Inquiries have been received from the Far East, but this country appears to continue non-competitive.

CROCEINE ACID continues a small regular trade at recent values.

DIMETHYLANILINE has been of chief interest on home account.

DIPHENYLAMINE.—Good orders have been booked at recent prices.

*H" ACID is steady.

NITROSOPHENOL.—Foreign Buyers are interested.

PARAPHENYLENEDIAMINE has been in fair request.

Coal Tar Products

With the exception of creosote, the market for most coal tar products is decidedly dull, and many products have depreciated in value since last week.

90% BENZOL is plentiful, and is worth about 1s. 1½d. to 1s. 2d. per gallon on rails in tank wagons.

PURE BENZOL is also in poor demand, and is worth about 1s. 5d. to 1s. 7d. per gallon on rails.

CREOSOTE OIL is firm, and in good demand. It is worth from 8½d. to 9d. per gallon on rails in the North, while in London the price is from 9½d. to 10d. per gallon.

CRESYLIC ACID is quiet and plentiful, and is quoted at 1s. 10d. to 2s. per gallon on rails for the pale quality 97/99%, while the dark quality 95/97% is worth from 1s. 6d. to 1s. 8d. per gallon.

SOLVENT NAPHTHA is also plentiful, and is quoted at 11d. to 1s. per gallon on rails.

HEAVY NAPHTHA shows no change at 1s. per gallon on rails.

NAPHTHALENES are steady at £7 to £7 10s. per ton for the low grade qualities, £8 to £8 10s. per ton for 74/76, and £8 15s. to £9 5s. per ton for 76/78 quality.

PITCH.—Prices continue to ease, the demand being extremely poor. To-day's values are:—102s. 6d. to 107s. 6d., f.o.b., London; 97s. 6d. to 102s. 6d., f.o.b., East Coast.

Sulphate of Ammonia

The market has an easier tendency.

[Current Market Prices on following pages.]

Soap and Oil Dealers' Bankruptcy

THE affairs of R. W. Hewitt and G. Cowen (lately carrying on business as Reginald Godfrey and Co.), merchants, 110, Cannon Street, E.C., came before Mr. Registrar Francke at the London Bankruptcy Court on December 7. The debtors, who were interested in the soap and oil trade, on a joint statement of affairs, had returned their liabilities at £10,080, of which £6,352 were expected to rank, and their assets at nil. Examined by the Official Receiver, Mr. Hewitt said that in January, 1917, he had entered into partnership with Cowen, and they began business as merchants at Bush Lane House, E.C., under the above style. In 1919 they removed to 110, Cannon Street, E.C. In the same year they entered into a partnership arrangement with one Solomon Bardiger and began an import business at Antwerp under the style of the Belgian Import Co. He first realised that the firm was insolvent in May, 1920, when the firm particularly felt the fall in the German mark, but they had not since contracted any liabilities.

The examination of both debtors was ordered to be concluded, the alleged causes of their insolvency being depreciation of goods, general depression in trade, damages for breach of contract and depreciation of the German exchange.

Indian Import Prohibitions

IN a supplement to the *Indian Trade Journal*, issued recently, there is given a list of articles whose importation into British India is prohibited. These include salt, and explosives (including acetylene and acetic acid) which are entirely prohibited. Quinine and preparations or compounds of narcotic alkaloids may be imported under special regulations only.

Current Market Prices

General Chemicals

| | Per | £ | s. | d. | £ | s. | d. | |
|--|------|-----|----|----|----|-----|----|----|
| Acetic anhydride, 90-95%..... | lb. | 0 | 1 | 4 | to | 0 | 1 | 5 |
| Acetone oil..... | ton | 80 | 0 | 0 | to | 85 | 0 | 0 |
| Acetone, pure..... | ton | 125 | 0 | 0 | to | 126 | 0 | 0 |
| Acid, Acetic, glacial, 99-100%..... | ton | 73 | 0 | 0 | to | 74 | 0 | 0 |
| Acetic, 80% pure..... | ton | 49 | 0 | 0 | to | 50 | 0 | 0 |
| Acetic, 40% pure..... | ton | 24 | 0 | 0 | to | 25 | 0 | 0 |
| Arsenic, liquid, 2000 s.g..... | ton | 85 | 0 | 0 | to | 88 | 0 | 0 |
| Boric, commercial..... | ton | 48 | 0 | 0 | to | 52 | 0 | 0 |
| Carbolic, cryst. 39-40%..... | lb. | 0 | 1 | 0½ | to | 0 | 1 | 1 |
| Citric..... | lb. | 0 | 1 | 5 | to | 0 | 1 | 5½ |
| Formic, 85%..... | ton | 60 | 0 | 0 | to | 62 | 0 | 0 |
| Hydrofluoric..... | lb. | 0 | 0 | 7½ | to | 0 | 0 | 8½ |
| Lactic, 50 vol..... | ton | 39 | 0 | 0 | to | 40 | 0 | 0 |
| Lactic, 60 vol..... | ton | 45 | 0 | 0 | to | 47 | 0 | 0 |
| Nitric, 80 Tw..... | ton | 24 | 0 | 0 | to | 25 | 0 | 0 |
| Oxalic..... | lb. | 0 | 0 | 5½ | to | 0 | 0 | 6 |
| Phosphoric, 1.5..... | ton | 35 | 0 | 0 | to | 38 | 0 | 0 |
| Pyrogallic, cryst..... | lb. | 0 | 5 | 9 | to | 0 | 6 | 0 |
| Salicylic, technical..... | lb. | 0 | 1 | 9½ | to | 0 | 2 | 0 |
| Sulphuric, 92-93%..... | ton | 6 | 0 | 0 | to | 7 | 0 | 0 |
| Tannic, commercial..... | lb. | 0 | 2 | 3 | to | 0 | 2 | 9 |
| Tartaric..... | lb. | 0 | 1 | 0½ | to | 0 | 1 | 1 |
| Alum, lump..... | ton | 12 | 10 | 0 | to | 13 | 0 | 0 |
| Chromic..... | ton | 23 | 0 | 0 | to | 24 | 0 | 0 |
| Alumino ferric..... | ton | 7 | 0 | 0 | to | 7 | 5 | 0 |
| Aluminium, sulphate, 14-15%..... | ton | 8 | 10 | 0 | to | 9 | 0 | 0 |
| Sulphate, 17-18%..... | ton | 10 | 10 | 0 | to | 11 | 0 | 0 |
| Ammonia, anhydrous..... | lb. | 0 | 1 | 6 | to | 0 | 1 | 8 |
| 880..... | ton | 32 | 0 | 0 | to | 34 | 0 | 0 |
| 920..... | ton | 22 | 0 | 0 | to | 24 | 0 | 0 |
| Carbonate..... | ton | 30 | 0 | 0 | to | 32 | 0 | 0 |
| Chloride..... | ton | 50 | 0 | 0 | to | 55 | 0 | 0 |
| Muriate (galvanisers)..... | ton | 32 | 0 | 0 | to | 33 | 0 | 0 |
| Nitrate (pure)..... | ton | 40 | 0 | 0 | to | 45 | 0 | 0 |
| Phosphate..... | ton | 63 | 0 | 0 | to | 65 | 0 | 0 |
| Sulphocyanide, commercial 90% lb. | lb. | 0 | 1 | 1 | to | 0 | 1 | 3 |
| Amyl acetate, technical..... | ton | 280 | 0 | 0 | to | 300 | 0 | 0 |
| Arsenic, white powdered..... | ton | 65 | 0 | 0 | to | 68 | 0 | 0 |
| Barium, carbonate, Witherite..... | ton | 5 | 0 | 0 | to | 6 | 0 | 0 |
| Carbonate, Precip..... | ton | 15 | 0 | 0 | to | 16 | 0 | 0 |
| Chlorate..... | ton | 65 | 0 | 0 | to | 70 | 0 | 0 |
| Chloride..... | ton | 15 | 0 | 0 | to | 15 | 10 | 0 |
| Nitrate..... | ton | 33 | 0 | 0 | to | 35 | 0 | 0 |
| Sulphate, blanc fixe, dry..... | ton | 20 | 10 | 0 | to | 21 | 0 | 0 |
| Sulphate, blanc fixe, pulp..... | ton | 10 | 5 | 0 | to | 10 | 10 | 0 |
| Sulphocyanide, 95%..... | lb. | 0 | 0 | 11 | to | 0 | 1 | 0 |
| Bleaching powder, 35-37%..... | ton | 10 | 7 | 6 | to | 10 | 17 | 6 |
| Borax crystals, commercial..... | ton | 25 | 0 | 0 | to | — | — | — |
| Calcium acetate, Brown..... | ton | 13 | 0 | 0 | to | 14 | 0 | 0 |
| Grey..... | ton | 22 | 0 | 0 | to | 23 | 0 | 0 |
| Carbide..... | ton | 13 | 0 | 0 | to | 13 | 10 | 0 |
| Chloride..... | ton | 5 | 15 | 0 | to | 6 | 0 | 0 |
| Carbon bisulphide..... | ton | 35 | 0 | 0 | to | 40 | 0 | 0 |
| Casein technical..... | ton | 80 | 0 | 0 | to | 90 | 0 | 0 |
| Cerium oxalate..... | lb. | 0 | 3 | 0 | to | 0 | 3 | 6 |
| Chromium acetate..... | lb. | 0 | 1 | 1 | to | 0 | 1 | 3 |
| Cobalt acetate..... | lb. | 0 | 6 | 0 | to | 0 | 6 | 6 |
| Oxide, black..... | lb. | 0 | 9 | 6 | to | 0 | 10 | 0 |
| Copper chloride..... | lb. | 0 | 1 | 1 | to | 0 | 1 | 2 |
| Sulphate..... | ton | 25 | 0 | 0 | to | 25 | 10 | 0 |
| Cream Tartar, 98-100%..... | ton | 86 | 0 | 0 | to | 88 | 0 | 0 |
| Epsom salts (see Magnesium sulphate) | ton | 66 | 0 | 0 | to | 67 | 0 | 0 |
| Formaldehyde, 40% vol..... | ton | 66 | 0 | 0 | to | 67 | 0 | 0 |
| Formosol (Rongalite)..... | lb. | 0 | 1 | 11 | to | 0 | 2 | 0 |
| Glauber salts, commercial..... | ton | 4 | 0 | 0 | to | 4 | 10 | 0 |
| Glycerin crude..... | ton | 65 | 0 | 0 | to | 67 | 10 | 0 |
| Hydrogen peroxide, 12 vols..... | gal | 0 | 2 | 0 | to | 0 | 2 | 1 |
| Iron perchloride..... | ton | 18 | 0 | 0 | to | 20 | 0 | 0 |
| Sulphate (Copperas)..... | ton | 3 | 10 | 0 | to | 4 | 0 | 0 |
| Lead acetate, white..... | ton | 44 | 0 | 0 | to | 46 | 0 | 0 |
| Carbonate (White Lead)..... | ton | 50 | 0 | 0 | to | 52 | 0 | 0 |
| Nitrate..... | ton | 44 | 10 | 0 | to | 45 | 0 | 0 |
| Litharge..... | ton | 37 | 0 | 0 | to | 39 | 0 | 0 |
| Lithophone, 30%..... | ton | 22 | 10 | 0 | to | 23 | 0 | 0 |
| Magnesium chloride..... | ton | 3 | 10 | 0 | to | 3 | 15 | 0 |
| Carbonate, light..... | cwt. | 2 | 10 | 0 | to | 2 | 15 | 0 |
| Sulphate (Epsom salts commercial)..... | ton | 5 | 15 | 0 | to | 6 | 0 | 0 |
| Sulphate (Druggists')..... | ton | 8 | 0 | 0 | to | 9 | 0 | 0 |
| Manganese Borate, commercial..... | ton | 65 | 0 | 0 | to | 75 | 0 | 0 |
| Sulphate..... | ton | 45 | 0 | 0 | to | 50 | 0 | 0 |
| Methyl acetone..... | ton | 82 | 0 | 0 | to | 85 | 0 | 0 |
| Alcohol, 1% acetone..... | ton | 80 | 0 | 0 | to | 85 | 0 | 0 |
| Nickel sulphate, single salt..... | ton | 37 | 0 | 0 | to | 38 | 0 | 0 |
| Ammonium sulphate, double salt ton | ton | 37 | 0 | 0 | to | 38 | 0 | 0 |

| | Per | £ | s. | d. | £ | s. | d. | |
|-----------------------------------|------|----|----|-----|----|----|----|-----|
| Potash, Caustic..... | ton | 32 | 0 | 0 | to | 34 | 0 | 0 |
| Potassium bichromate..... | lb. | 0 | 0 | 5½ | to | 0 | 0 | 6 |
| Carbonate, 90%..... | ton | 30 | 0 | 0 | to | 31 | 0 | 0 |
| Chloride, 80%..... | ton | 9 | 0 | 0 | to | 10 | 0 | 0 |
| Chlorate..... | lb. | 0 | 0 | 3½ | to | — | — | — |
| Metabisulphite, 50-52%..... | ton | 65 | 0 | 0 | to | 70 | 0 | 0 |
| Nitrate, refined..... | ton | 38 | 0 | 0 | to | 40 | 0 | 0 |
| Permanganate..... | lb. | 0 | 0 | 10½ | to | 0 | 0 | 10½ |
| Prussiate, red..... | lb. | 0 | 2 | 10 | to | 0 | 3 | 0 |
| Prussiate, yellow..... | lb. | 0 | 0 | 10½ | to | 0 | 0 | 11 |
| Sulphate, 90%..... | ton | 10 | 0 | 0 | to | 10 | 10 | 0 |
| Salammoniac, firsts..... | cwt. | 2 | 15 | 0 | to | — | — | — |
| Seconds..... | cwt. | 2 | 17 | 6 | to | — | — | — |
| Sodium acetate..... | ton | 25 | 0 | 0 | to | 25 | 10 | 0 |
| Arsenate, 45%..... | ton | 45 | 0 | 0 | to | 48 | 0 | 0 |
| Bicarbonate..... | ton | 10 | 10 | 0 | to | 11 | 0 | 0 |
| Bichromate..... | lb. | 0 | 0 | 4½ | to | 0 | 0 | 4½ |
| Bisulphite, 60-62%..... | ton | 21 | 0 | 0 | to | 23 | 0 | 0 |
| Chlorate..... | lb. | 0 | 0 | 3 | to | 0 | 0 | 3½ |
| Caustic, 70%..... | ton | 17 | 10 | 0 | to | 18 | 0 | 0 |
| Caustic, 76%..... | ton | 18 | 10 | 0 | to | 19 | 0 | 0 |
| Hydrosulphite, powder..... | lb. | 0 | 1 | 5 | to | 0 | 1 | 6 |
| Hyposulphite, commercial..... | ton | 10 | 10 | 0 | to | 11 | 0 | 0 |
| Nitrite, 96-98%..... | ton | 29 | 0 | 0 | to | 30 | 0 | 0 |
| Phosphate, crystal..... | ton | 16 | 0 | 0 | to | 16 | 10 | 0 |
| Perborate..... | lb. | 0 | 0 | 11 | to | 0 | 1 | 0 |
| Prussiate..... | lb. | 0 | 0 | 6 | to | — | — | — |
| Sulphide, crystals..... | ton | 8 | 10 | 0 | to | 9 | 0 | 0 |
| Sulphide, solid, 60-62%..... | ton | 15 | 0 | 0 | to | 16 | 10 | 0 |
| Sulphite, cryst..... | ton | 11 | 10 | 0 | to | 12 | 0 | 0 |
| Strontium carbonate..... | ton | 50 | 0 | 0 | to | 55 | 0 | 0 |
| Nitrate..... | ton | 50 | 0 | 0 | to | 55 | 0 | 0 |
| Sulphate, white..... | ton | 6 | 10 | 0 | to | 7 | 10 | 0 |
| Sulphur chloride..... | ton | 25 | 0 | 0 | to | 27 | 10 | 0 |
| Flowers..... | ton | 11 | 0 | 0 | to | 11 | 10 | 0 |
| Roll..... | ton | 9 | 15 | 0 | to | 10 | 10 | 0 |
| Tartar emetic..... | lb. | 0 | 0 | 11½ | to | 0 | 1 | 0 |
| Tin perchloride, 33%..... | lb. | 0 | 1 | 1 | to | 0 | 1 | 2 |
| Perchloride, solid..... | lb. | 0 | 1 | 3 | to | 0 | 1 | 4 |
| Protochloride (tin crystals)..... | lb. | 0 | 1 | 4 | to | 0 | 1 | 5 |
| Zinc chloride 102° Tw..... | ton | 20 | 0 | 0 | to | 21 | 0 | 0 |
| Chloride, solid, 96-98%..... | ton | 25 | 0 | 0 | to | 30 | 0 | 0 |
| Oxide, 99%..... | ton | 42 | 0 | 0 | to | 45 | 0 | 0 |
| Dust, 90%..... | ton | 50 | 0 | 0 | to | 55 | 0 | 0 |
| Sulphate..... | ton | 15 | 0 | 0 | to | 16 | 0 | 0 |

Pharmaceutical Chemicals

| | | | | | | | | |
|---|------|---|----|----|----|---|----|----|
| Acetyl salicylic acid..... | lb. | 0 | 3 | 9 | to | 0 | 4 | 0 |
| Acetanilid..... | lb. | 0 | 3 | 3 | to | 0 | 3 | 6 |
| Acid, Gallic, pure..... | lb. | 0 | 3 | 0 | to | 0 | 3 | 3 |
| Lactic, 1.21..... | lb. | 0 | 2 | 10 | to | 0 | 3 | 3 |
| Salicylic, B.P..... | lb. | 0 | 2 | 6 | to | 0 | 2 | 8 |
| Tannic, lewiss..... | lb. | 0 | 3 | 2 | to | 0 | 3 | 4 |
| Amidol..... | lb. | 0 | 7 | 6 | to | 0 | 8 | 0 |
| Amidopyrin..... | lb. | 0 | 14 | 0 | to | 0 | 14 | 6 |
| Ammon ichthosulphonate..... | lb. | 0 | 1 | 10 | to | 0 | 2 | 0 |
| Barbitone..... | lb. | 0 | 17 | 6 | to | 0 | 18 | 6 |
| Beta naphthol resublimed..... | lb. | 0 | 2 | 6 | to | 0 | 2 | 9 |
| Bromide of ammonia..... | lb. | 0 | 0 | 10 | to | 0 | 1 | 0 |
| Potash..... | lb. | 0 | 0 | 9 | to | 0 | 0 | 9 |
| Soda..... | lb. | 0 | 0 | 9 | to | 0 | 0 | 10 |
| Caffeine, pure..... | lb. | 0 | 12 | 3 | to | 0 | 12 | 9 |
| Calcium glycerophosphate..... | lb. | 0 | 5 | 9 | to | 0 | 6 | 0 |
| Lactate..... | lb. | 0 | 2 | 3 | to | 0 | 2 | 6 |
| Calomel..... | lb. | 0 | 3 | 9 | to | 0 | 4 | 0 |
| Chloral hydrate..... | lb. | 0 | 4 | 3 | to | 0 | 4 | 6 |
| Cocaine alkaloid..... | oz. | 0 | 19 | 6 | to | 1 | 0 | 0 |
| Hydrochloride..... | oz. | 0 | 16 | 9 | to | 0 | 17 | 3 |
| Corrosive sublimate..... | lb. | 0 | 3 | 3 | to | 0 | 3 | 6 |
| Eucalyptus oil, B.P. (70-75% eucalyptol)..... | lb. | 0 | 2 | 6 | to | 0 | 2 | 8 |
| B.P. (75-80% eucalyptol)..... | lb. | 0 | 2 | 7 | to | 0 | 2 | 9 |
| Guaiaacal carbonate..... | lb. | 0 | 13 | 6 | to | 0 | 14 | 0 |
| Liquid..... | lb. | 0 | 12 | 6 | to | 0 | 13 | 0 |
| Pure crystals..... | lb. | 0 | 13 | 0 | to | 0 | 13 | 6 |
| Hexamine..... | lb. | 0 | 4 | 6 | to | 0 | 4 | 9 |
| Hydroquinone..... | lb. | 0 | 4 | 3 | to | 0 | 4 | 6 |
| Lanoline anhydrous..... | lb. | 0 | 0 | 7 | to | 0 | 0 | 6 |
| Lecithin ex ovo..... | lb. | 1 | 5 | 0 | to | 1 | 7 | 6 |
| Lithi carbonate..... | lb. | 0 | 9 | 6 | to | 0 | 10 | 0 |
| Methyl salicylate..... | lb. | 0 | 3 | 0 | to | 0 | 3 | 6 |
| Metol..... | lb. | 0 | 9 | 0 | to | 0 | 10 | 0 |
| Milk sugar..... | cwt. | 4 | 2 | 6 | to | 4 | 10 | 0 |
| Paraldehyde..... | lb. | 0 | 1 | 7 | to | 0 | 1 | 9 |
| Phenacetin..... | lb. | 0 | 7 | 9 | to | 0 | 8 | 3 |
| Phenazone..... | lb. | 0 | 8 | 6 | to | 0 | 9 | 0 |
| Phenolphthalein..... | lb. | 0 | 8 | 3 | to | 0 | 8 | 6 |
| Potassium sulpho guaiaacolate..... | lb. | 0 | 7 | 3 | to | 0 | 7 | 9 |
| Quinine sulphate, B.P..... | oz. | 0 | 2 | 3 | to | — | — | — |

| | Per | £ | s. | d. | £ | s. | d. |
|-----------------------------------|-----|----|----|----|---|----|----|
| Resorcin, medicinal.....lb. | 0 | 5 | 9 | to | 0 | 6 | 0 |
| Salicylate of soda powder.....lb. | 0 | 3 | 0 | to | 0 | 3 | 3 |
| Crystals.....lb. | 0 | 3 | 0 | to | 0 | 3 | 3 |
| Salol.....lb. | 0 | 4 | 0 | to | 0 | 4 | 3 |
| Soda Benzoate.....lb. | 0 | 3 | 6 | to | 0 | 3 | 9 |
| Sulphonol.....lb. | 0 | 17 | 0 | to | 0 | 18 | 0 |
| Terpene hydrate.....lb. | 0 | 1 | 9 | to | 0 | 2 | 0 |
| Theobromine, pure.....lb. | 0 | 12 | 0 | to | 0 | 12 | 3 |
| Soda salicylate.....lb. | 0 | 8 | 6 | to | 0 | 9 | 0 |
| Vanillin.....lb. | 1 | 3 | 6 | to | 1 | 4 | 6 |

Coal Tar Intermediates, &c.

| | | | | | | | |
|---|---|----|-----|----|---|----|----|
| Alphanaphthol, crude.....lb. | 0 | 2 | 0 | to | 0 | 2 | 3 |
| Refined.....lb. | 0 | 2 | 6 | to | 0 | 2 | 9 |
| Alphanaphthylamine.....lb. | 0 | 1 | 6½ | to | 0 | 1 | 7 |
| Aniline oil, drums extra.....lb. | 0 | 0 | 9 | to | 0 | 0 | 9½ |
| Salts.....lb. | 0 | 0 | 9½ | to | 0 | 0 | 10 |
| Anthracene, 40-50%.....unit | 0 | 0 | 8½ | to | 0 | 0 | 9 |
| Benzaldehyde (free of chlorine).....lb. | 0 | 2 | 6 | to | 0 | 2 | 9 |
| Benidine, base.....lb. | 0 | 4 | 9 | to | 0 | 5 | 0 |
| Sulphate.....lb. | 0 | 3 | 9 | to | 0 | 4 | 0 |
| Benzoic acid.....lb. | 0 | 2 | 0 | to | 0 | 2 | 3 |
| Benzyl chloride, technical.....lb. | 0 | 2 | 0 | to | 0 | 2 | 3 |
| Betanaphthol.....lb. | 0 | 1 | 1 | to | 0 | 1 | 2 |
| Betanaphthylamine, technical.....lb. | 0 | 4 | 0 | to | 0 | 4 | 3 |
| Croceine Acid, 100% basis.....lb. | 0 | 3 | 3 | to | 0 | 3 | 6 |
| Dichlorobenzol.....lb. | 0 | 0 | 9 | to | 0 | 0 | 10 |
| Diethylaniline.....lb. | 0 | 4 | 6 | to | 0 | 4 | 9 |
| Dinitrobenzol.....lb. | 0 | 1 | 1 | to | 0 | 1 | 2 |
| Dinitrochlorobenzol.....lb. | 0 | 0 | 11 | to | 0 | 0 | 1 |
| Dinitronaphthalene.....lb. | 0 | 1 | 4 | to | 0 | 1 | 5 |
| Dinitrotoluol.....lb. | 0 | 1 | 4 | to | 0 | 1 | 5 |
| Dinitrophenol.....lb. | 0 | 1 | 6 | to | 0 | 1 | 7 |
| Dimethylaniline.....lb. | 0 | 2 | 9 | to | 0 | 3 | 0 |
| Diphenylamine.....lb. | 0 | 3 | 6 | to | 0 | 3 | 9 |
| H-Acid.....lb. | 0 | 4 | 9 | to | 0 | 5 | 0 |
| Metaphenylenediamine.....lb. | 0 | 4 | 0 | to | 0 | 4 | 3 |
| Monochlorobenzol.....lb. | 0 | 0 | 10 | to | 0 | 0 | 1 |
| Metanilic Acid.....lb. | 0 | 5 | 9 | to | 0 | 6 | 0 |
| Metatoluylenediamine.....lb. | 0 | 4 | 0 | to | 0 | 4 | 3 |
| Monosulphonic Acid (2.7).....lb. | 0 | 8 | 6 | to | 0 | 9 | 6 |
| Naphthionic acid, crude.....lb. | 0 | 2 | 6 | to | 0 | 2 | 8 |
| Naphthionate of Soda.....lb. | 0 | 2 | 6 | to | 0 | 2 | 8 |
| Naphthylamine-di-sulphonic-acid.....lb. | 0 | 4 | 0 | to | 0 | 4 | 3 |
| Nevill Winter Acid.....lb. | 0 | 7 | 3 | to | 0 | 7 | 9 |
| Nitrobenzol.....lb. | 0 | 0 | 7 | to | 0 | 0 | 8 |
| Nitronaphthalene.....lb. | 0 | 0 | 11½ | to | 0 | 0 | 1 |
| Nitrotoluol.....lb. | 0 | 0 | 8 | to | 0 | 0 | 9 |
| Orthoamidophenol base.....lb. | 0 | 12 | 0 | to | 0 | 12 | 6 |
| Orthodichlorobenzol.....lb. | 0 | 1 | 0 | to | 0 | 1 | 1 |
| Orthotoluidine.....lb. | 0 | 0 | 10 | to | 0 | 0 | 11 |
| Orthonitrotoluol.....lb. | 0 | 0 | 3 | to | 0 | 0 | 4 |
| Para-amidophenol, base.....lb. | 0 | 8 | 6 | to | 0 | 9 | 0 |
| Hydrochlor.....lb. | 0 | 7 | 6 | to | 0 | 8 | 0 |
| Paradichlorobenzol.....lb. | 0 | 0 | 9 | to | 0 | 0 | 10 |
| Paranitraniline.....lb. | 0 | 2 | 7 | to | 0 | 2 | 9 |
| Paranitrophenol.....lb. | 0 | 2 | 3 | to | 0 | 2 | 6 |
| Paranitrotoluol.....lb. | 0 | 2 | 9 | to | 0 | 3 | 0 |
| Paraphenylenediamine, distilled.....lb. | 0 | 12 | 0 | to | 0 | 12 | 6 |
| Paratoluidine.....lb. | 0 | 5 | 6 | to | 0 | 5 | 9 |
| Phthalic anhydride.....lb. | 0 | 2 | 6 | to | 0 | 2 | 9 |
| Resorcin technical.....lb. | 0 | 4 | 0 | to | 0 | 4 | 3 |
| Sulphanilic acid, crude.....lb. | 0 | 0 | 10 | to | 0 | 0 | 11 |
| Tolidine, base.....lb. | 0 | 7 | 3 | to | 0 | 7 | 9 |
| Mixture.....lb. | 0 | 2 | 6 | to | 0 | 2 | 9 |

Essential Oils and Synthetics

| | ESSENTIAL OILS. | £ | s. | d. |
|---|-----------------|----|----|----|
| Anise.....c.i.f. 1/9 spot | 0 | 1 | 10 | 0 |
| Bay..... | 0 | 12 | 0 | 0 |
| Bergamot..... | 0 | 13 | 0 | 0 |
| Cajaput.....firm | 0 | 3 | 3 | 0 |
| Camphor, white.....per cwt. | 4 | 0 | 0 | 0 |
| Brown..... | 3 | 15 | 0 | 0 |
| Cassia.....forward position weak, c.i.f. 8/- spot | 0 | 10 | 6 | 0 |
| Cedarwood..... | 0 | 1 | 6 | 0 |
| Citronella (Ceylon).....weaker, c.i.f. 3/10½ spot | 0 | 4 | 2 | 0 |
| (Java).....firm, c.i.f. spot | 0 | 4 | 7 | 0 |
| Clove..... | 0 | 9 | 6 | 0 |
| Eucalyptus..... | 0 | 2 | 6 | 0 |
| Geranium Bourbon.....firm | 1 | 16 | 0 | 0 |
| Lavender.....firm | 1 | 6 | 0 | 0 |
| Lavender Spike..... | 0 | 3 | 3 | 0 |
| Lemon..... | 0 | 2 | 10 | 0 |
| Lemongrass.....per oz. | 0 | 0 | 2½ | 0 |
| Lime (distilled)..... | 0 | 4 | 0 | 0 |

| | | | | |
|------------------------------------|---|----|---|---|
| Orange sweet (Sicilian)..... | 0 | 10 | 6 | 0 |
| (West Indian)..... | 0 | 8 | 6 | 0 |
| Palmarosa..... | 1 | 0 | 0 | 0 |
| Peppermint (American)..... | 0 | 16 | 0 | 0 |
| Mint (dementholised Japanese)..... | 0 | 12 | 3 | 0 |
| Patchouli..... | 1 | 5 | 0 | 0 |
| Otto of Rose.....per oz. | 1 | 15 | 0 | 0 |
| Rosemary..... | 0 | 1 | 9 | 0 |
| Sandalwood..... | 1 | 5 | 0 | 0 |
| Sassafras..... | 0 | 7 | 6 | 0 |
| Thyme.....2/6 to | 0 | 8 | 0 | 0 |

SYNTHETICS.

| | | | | |
|----------------------------|---|----|---|---|
| Benzyl acetate.....per lb. | 0 | 3 | 3 | 0 |
| Benzoate..... | 0 | 3 | 6 | 0 |
| Citral..... | 0 | 9 | 6 | 0 |
| Coumarin..... | 1 | 0 | 0 | 0 |
| Heliotropine..... | 0 | 8 | 0 | 0 |
| Ionone..... | 1 | 5 | 0 | 0 |
| Linalyl acetate..... | 1 | 2 | 6 | 0 |
| Methyl salicylate.....firm | 0 | 3 | 0 | 0 |
| Musk xylol.....firm | 0 | 12 | 6 | 0 |
| Terpeniol..... | 0 | 2 | 9 | 0 |

Preparation of Ferric Salts

A RECENT investigation on the preparation of ferric salts has been concluded by the United States Department of the Interior at the Pacific Experiment Station of the Bureau of Mines, Berkeley, California. The object of this investigation was to prepare solutions of ferric salts suitable for the hydrometallurgy of complex ores, and by methods that would have promise of commercial success due to their simplicity and cheapness. Observations made at the Tucson station of the Bureau of Mines that ferrous sulphate solutions could be oxidised to ferric solutions by air containing a small amount of sulphur dioxide, with simultaneous formation of sulphuric acid, were taken at the basis of a long research on oxidation by air. In stronger solutions the first thing that happens is oxidation of ferrous to ferric sulphate from hydrolysing. Later, sulphuric acid begins to form, and continues up to a 4 or 5 per cent. solution. Acidity of the solutions tends to prevent these reactions taking place with any speed, particularly if all the iron is present at the beginning as ferrous sulphate. The optimum temperature for this reaction is about 35° to 40° C., which is easily attained by using warm or hot burner, or roaster gases. The application of this process to the treatment of ores is being followed up by the Bureau of Mines at the Tucson station.

Paints, Oils, etc., Required in Egypt

THE British Commercial Agent for Egypt has forwarded to the Department of Overseas Trade particulars of a call for tenders for the supply of various stores required during 1924-25 by the Port and Lighthouses Administration, Alexandria, comprising considerable quantities of paints (mixed and in powder), varnishes, various oils (boiled and raw linseed, bicycle, clock, colza, etc.), shellac, coal and Stockholm tar, tallow, soap, etc. The specification, conditions, and form of tender may be seen by British firms interested on application at the Department, 35, Old Queen Street, London, S.W.1, while a further set of these documents is available for loan, in order of application, to firms in the provinces who may be unable to arrange for inspection in London. (Ref. D.O.T. 11944/F.E./C.C.)

Increased Chemical Exports and Imports

THE Board of Trade returns for November show the following totals: Imports, £101,584,990, increase on 1922 of £6,028,338; exports, £65,768,155, decrease on 1922 of £722,629; re-exports, £10,711,110, increase on 1922 of £1,022,982.

In chemicals, drugs, dyes, and colours the returns show an increase in value both in exports and imports. The total value of exports was £2,014,741, an increase of £138,672 on 1922; the total value of imports was £1,138,282, an increase of £70,196 on 1922. The exports, as regards total value and the proportion of increase, considerably exceed the imports. The consistent increase in the export of dyestuffs is notable, namely 21,436 cwt. in November, 1923, 12,485 cwt. in 1922, and 9,792 in 1921.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, December 13, 1923.

BUSINESS in the heavy chemical market during the past week has been particularly quiet, no doubt on account of the political activity. Prices on the whole are well maintained, with German products inclined to be still higher.

There has been a moderate export inquiry.

Industrial Chemicals

ACID ACETIC.—Export inquiries still being received. Glacial, 98/100%, £60 to £66 per ton; 80% pure, £49 to £50 per ton; 80% technical, £47 to £48 per ton, packed in casks delivered, c.i.f. U.K. port, duty free.

ACID BORACIC.—Crystals or granulated, £48 per ton; powdered, £50 per ton, carriage paid U.K. stations, minimum ton lots.

ACID CARBOLIC (ICE CRYSTALS).—In very poor demand, nominally 1s. 1d. per lb., but could probably be obtained for less.

ACID CITRIC (B.P. CRYSTALS).—Small local inquiry. Price about 1s. 5d. per lb., less 5% ex store.

ACID FORMIC 85%.—Spot material very scarce. Quoted £60 to £61 per ton, ex station.

ACID HYDROCHLORIC.—In little demand. Price 6s. 6d. per carboy, ex works.

ACID NITRIC 80%.—£23 10s. per ton, ex station, full truck loads.

ACID OXALIC.—Moderate inquiry. Price about 6d. per lb., ex store, spot delivery.

ACID SULPHURIC.—140°, £3 15s. per ton; 168°, £7 per ton, ex works, full truck loads. Dearsenicated quality 20s. per ton more.

ACID TARTARIC (B.P. CRYSTALS).—Unchanged at about 1s. 1d. per lb., less 5% ex wharf.

ALUMINA SULPHATE.—17/18% Iron free.—Quoted £8 5s. per ton, c.i.f. U.K. port, prompt shipment. Spot lots obtainable at about £8 12s. 6d. per ton, ex store.

ALUM, CHROME.—Moderate export inquiry. Quoted £26 to £28 per ton delivered, f.o.b. U.K. port.

ALUM, POTASH (LUMP).—English material unchanged at about £10 17s. 6d. per ton, f.o.b. U.K. port. Spot lots of continental material still available at about £11 10s. per ton, ex store.

AMMONIA, ANHYDROUS.—Unchanged at about 1s. 5d. per lb., ex station, prompt delivery.

AMMONIA, CARBONATE.—Lump, £29 5s. per ton; powder, £31 per ton, f.o.b. U.K. port for export.

AMMONIA LIQUID 880°.—Unchanged at 3d. per lb., delivered. Containers extra.

AMMONIA MURIATE.—Grey galvanisers quality quoted £34 per ton, f.o.b. U.K. port for export. Fine white crystals on offer at about £28 per ton, ex store, spot delivery.

AMMONIA SULPHATE.—25½% material, £13 2s. per ton; 25¾% neutral quality, £14 5s. per ton, ex works, December delivery.

ARSENIC, WHITE POWDERED.—Fresh Cornish material practically unobtainable, but some second-hand spot lots offering at about £70 per ton, ex store. Continental material unchanged at about £63 10s. per ton, c.i.f. U.K. port.

BARIUM CHLORIDE 98/100%.—English material unchanged at about £15 per ton, ex store.

BARYTES.—Finest white English unchanged at £5 5s. per ton, ex works. Good quality continental material offered at £5 per ton c.i.f. U.K. ports.

BLEACHING POWDER.—Spot lots, £11 5s. per ton, ex station. Contracts, 20s. per ton less.

BORAX.—Granulated, £24 10s. per ton; Crystal, £25 per ton; Powdered, £26 per ton, carriage paid U.K. stations, minimum ton lots.

CALCIUM CHLORIDE.—English material unchanged at £5 12s. 6d. per ton, ex station. Continental offered at about £4 15s. per ton, ex store.

COPPERAS, GREEN.—Quoted £2 5s. per ton, f.o.b. U.K. port.

COPPER SULPHATE.—Good inquiry for export. Price about £25 5s. per ton, less 5%, f.o.b. U.K. port.

FORMALDEHYDE 40%.—Moderate inquiry. Spot materials still available at about £65 to £66 per ton, ex store.

GLAUBER SALTS.—Fine white crystals quoted £3 12s. 6d. per ton, ex store, spot delivery. Continental material still offering at about £3 per ton, c.i.f. U.K. port.

LEAD, RED.—English material unchanged at £45 per ton, carriage paid U.K. stations. Continental about £36 10s. per ton, c.i.f. U.K. port. Spot material offered at £37 15s. per ton, ex store.

LEAD, WHITE.—Continental material now offered at about £42 per ton, ex store, spot delivery.

LEAD, ACETATE.—Spot material scarce. Continental quoted about £44 per ton, ex store, spot delivery. English material for export quoted £46 per ton, f.o.b. U.K. port.

MAGNESITE CALCINED.—Finest English material offered at £8 per ton, ex station.

MAGNESIUM, CHLORIDE.—Unchanged at about £3 15s. per ton, ex store, spot delivery. Still on offer from the continent at about £2 12s. 6d. per ton, c.i.f. U.K. port.

MAGNESIUM SULPHATE (Epsom Salts).—Commercial quality offered at about £5 per ton, ex store. B.P. quality, £6 5s. per ton, ex station, prompt delivery.

POTASH CAUSTIC, 88/92%.—Spot material still available at about £33 per ton, ex store. Offered from the continent at about £30 per ton, c.i.f. U.K. port.

POTASSIUM BICHROMATE.—Unchanged at 5½d. per lb. delivered.

POTASSIUM CARBONATE, 96/98%.—Spot material inclined to be scarce. Quoted £30 per ton, ex store. Still on offer from the continent at about £26 per ton, c.i.f. U.K. port.

POTASSIUM CHLORATE.—Unchanged, at about 3½d. per lb., ex store.

POTASSIUM NITRATE (SALTPETRE).—Quoted £32 per ton, ex store, spot delivery.

POTASSIUM PERMANGANATE (B.P. Crystals).—Inclined to be higher at about 10½d. per lb., ex store, spot delivery.

POTASSIUM PRUSSIAN (YELLOW).—Still in poor demand. Quoted 10½d. per lb., f.o.b. U.K. port, for export. Spot material on offer at about 10½d. per lb., ex station.

SODA CAUSTIC.—76/77% £19 7s. 6d. per ton; 70/72%, £17 17s. 6d. per ton; £60/62% broken, £19 2s. 6d. per ton; 98/99% powdered, £22 15s. per ton. All ex station spot delivery. Contracts 20s. per ton less.

SODIUM ACETATE.—Unchanged at about £26 per ton, ex store.

SODIUM BICARBONATE.—Refined recrystallised quality, £10 1s. per ton, ex quay or station. M.W. quality, 30s. per ton less.

SODIUM BICHROMATE.—Unchanged at 4½d. per lb., delivered.

SODIUM CARBONATE.—Soda Crystals, £5 to £5 5s. per ton, ex quay or station; Alkali 58%, £8 12s. 3d. per ton, ex quay or station.

SODIUM HYPOSULPHITE.—English makers' price about £10 per ton, ex station. Continental obtainable at about the same figure. Pea crystals quoted £15 per ton, ex store.

SODIUM NITRATE.—Refined 96/98% quality unchanged at about £13 5s. per ton, f.o.r. or f.o.b. U.K. port.

SODIUM NITRITE, 100%.—Quoted £26 to £28 per ton, according to quantity, f.o.b. U.K. port.

SODIUM PRUSSIAN (YELLOW).—In little demand. Price about 5½d. per lb., ex store.

SODIUM SULPHATE (SALTCAKE).—Price for home consumption £4 5s. per ton, carriage paid stations. Good export inquiry.

SODIUM SULPHIDE.—60/62% solid, £15 per ton, ex station; broken £1 per ton more; 31/34% crystals, £9 7s. 6d., per ton, ex station.

SULPHUR.—Flowers, £10 per ton; roll, £9 per ton; rock, £9 per ton; ground, £8 per ton. Prices nominal.

TIN, CRYSTALS.—Unchanged at 1s. 3½d. per lb. f.o.b. U.K. port or delivered.

ZINC CHLORIDE.—98/100% solid offered at about £26 per ton, f.o.b. U.K. port, for export.

NOTE.—The above prices are for bulk business, and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ANILINE OIL.—Fair demand, for export. Price 11d. per lb., drums included.

ANILINE SALT.—Considerable export inquiry. Price 10d. per lb., f.o.b.

ACETANILIDE.—Small home inquiries. Price 1s. 8d. per lb. delivered.

BETA NAPHTHOL.—Small export inquiries. Price 1s. 1d. per lb. f.o.b.

BENZIDINE BASE.—Small home inquiry. Price 4s. 7d. per lb., 100% basis, carriage paid.

DINITROCHLOROBENZOL.—Good export demand. Price £90 per ton, f.o.b.

DIMETHYLANILINE.—Export inquiry. Price 2s. 6d. per lb., f.o.b., drums included.

DINITRO OXY NAPHTHALENE.—Export inquiry. Price 6s. 6d. per lb., 100% basis, f.o.b.

DI ETHYL PHTHALATE.—Some inquiry. Price 5s. 3d. per lb., delivered.

DIPHENYLAMINE.—Home inquiry. Price 3s. 3d. per lb., delivered.

H ACID.—Some export inquiry. Price 4s. 6d. per lb., 100% basis, f.o.b.

META TOLUYLENE DIAMINE.—Steady demand. Price 4s. per lb., delivered or f.o.b.

META PHENYLENE DIAMINE.—Export inquiry. Price 4s. 6d. per lb., f.o.b.

META XYLIDINE ACETATE.—Small inquiry. Price 9s. 10d. per lb., 100% basis, carriage paid.

NEVILLE WINTHER ACID.—Export inquiry. Price 5s. 11d. per lb., 100% basis, f.o.b.

PHTHALIC ANHYDRIDE.—Regular demand. Price fairly steady. 2s. per lb., delivered or f.o.b.

PARA AMIDO PHENOL.—Good home demand. Price 8s. 6d. per lb., 100% basis, f.o.b.

S ACID.—Export inquiry. Price 12s. 6d. per lb., 100% basis, f.o.b.

TOBIAS ACID.—Some home inquiries. Price quoted 5s. 10d. per lb., 100% basis, delivered.

Canadian Exports of Carbide

ACCORDING to an official return issued by the Dominion Bureau of Statistics of Canada, the total exports of calcium carbide from that country during October were 11,359 cwt., valued at \$43,314. Of this amount none came to the United Kingdom, the majority being taken by the United States, which received 7,870 cwt., and Mexico, which received 1,026 cwt. The total figure represents a considerable decrease on that for the corresponding month of 1922, when 25,783 cwt., valued at \$104,416, were exported. For the twelve months ended October this year (1923) 313,792 cwt. were exported as against 587,704 cwt. for the corresponding period ended October, 1922.

Irish Section of the Institute of Chemistry

THE ANNUAL GENERAL meeting of the Irish Free State Section of the Institute of Chemistry of Great Britain and Ireland was held in the Chemical Lecture Theatre, Trinity College, Dublin, Professor Sydney Young, F.R.S., presiding. The annual reports of the Hon. Secretary and Treasurer were submitted and adopted.

Messrs. W. J. Barratt, A. C. Brooks, A. J. C. Cosbie, M. V. Sargent, H. S. Scales and T. G. Webb were formally admitted to membership of the Institute. The following were elected members of Committee for the current session:—Professor W. E. Adeney, D.Sc., F.R.C.Sc.I., F.I.C.; B. G. Fagan, B.Sc., A.R.C.Sc.I., F.I.C.; Dr. A. G. G. Leonard, F.R.C.Sc.I., F.I.C.; Dr. J. H. Millar, F.I.C.; A. O'Farrelly, M.A., F.I.C.; J. W. Parkes, M.Sc., A.I.C.; Professor Hugh Ryan, D.Sc., F.I.C.; Professor Sydney Young, F.R.S., F.I.C.

Mr. D. Mellon, A.I.C., proposed, and Mr. J. W. Parkes, M.Sc., A.I.C., seconded, the following resolution, which was unanimously passed:—"That this meeting of the Irish Free State Section of the Institute of Chemistry views with regret the continued closing of the College of Science, and is of opinion that it is essential, in the interests of industry and education in applied science, that the buildings and equipment of the College should be restored to their normal functions."

The Manchester Chemical Market

(FROM OUR OWN CORRESPONDENT.)

Manchester, December 13, 1923.

BUSINESS is again only on modest lines on the Manchester market, and traders here are not anticipating any extension in the demand, at all events until the Christmas holidays have been left behind. It is likely, however, that business will pick up somewhat with the turn of the year. As stocks in consumers' hands are small, any developments in the using industries will quickly react on the chemical market. Some shipments to the Continent have recently been made, although they have been on a small scale.

Heavy Chemicals

Caustic soda is in fair demand for export, though home business is quieter; values, however, are steady at from £16 17s. 6d. per ton for 60 per cent. material to £19 7s. 6d. for 76-77 per cent. Inquiry for hyposulphite of soda has been a shade more active and prices are unchanged from last week at £15 10s. per ton for photographic quality and £10 per ton for commercial. Alkali keeps fairly active and prices are maintained at £7 10s. per ton for 58 per cent. quality. Bleaching powder is rather quiet at the moment, with prices steady at £11 5s. per ton. Glauber salts are quoted at round £3 10s. per ton, with little business being put through. Nitrite of soda is firmly maintained on short stocks at £28 10s. to £29 per ton. Saltcake is meeting with a fairly good inquiry for shipment, though home demand is only moderate; prices are steady at round £4 10s. per ton. Sulphide of sodium is rather quiet at £14 10s. per ton for 60-65 per cent. concentrated solid and £9 per ton for crystals. Prussiate of soda keeps quiet and easy at 5½d. per lb. Bicarbonate of soda is steady and in fairly good demand at £10 10s. per ton. Phosphate of soda is quiet but unchanged from last week at £14 to £14 10s. per ton. Acetate of soda values are well held at £23 10s. to £24 per ton, though not much actual business has been done. Soda crystals still only rouse moderate buying interest at £5 5s. per ton. Bichromate of soda is fairly active at 4½d. per lb. Chlorate of soda values are well maintained at round 3d. per lb.

The demand for both caustic potash and carbonate is rather good and values are firm. Caustic potash, 90 per cent. strength, is quoted at £30 to £32 per ton, with carbonate at about £24 for 90 per cent., £26 per ton for 96 per cent. Chlorate of potash is meeting with a quietly steady demand at 3d. to 3½d. per lb. Permanganate of potash is quiet but unchanged at 8½d. to 9d. per lb. Yellow prussiate of potash, also, attracts only a moderate amount of buying interest and values continue on the easy side, current rates being about 9½d. per lb.

Arsenic is still meeting with a fairly ready sale for shipmen and prices here are on the basis of round £70 per ton, Manchester, for white powdered, Cornish makes. Sulphate of copper is rather dull and comparatively little business is being put through; quotations, however, are about unchanged at £25 10s. per ton, f.o.b. Commercial Epsom salts are in quietly steady demand, and prices are firm at from £4 to £4 5s. per ton; magnesium sulphate, B.P., is quoted at round £6 per ton. Nitrate of lead keeps steady at £42 to £44 per ton. Lead acetates are quiet but firm, white again being quoted at £44, and brown £45 per ton. Acetates of lime are only in moderate demand, but current values are firmly maintained at £21 to £22 for grey and £14 per ton for brown.

Acids and Tar Products

Not much change has taken place in the position of tartaric and citric acids. Tartaric is quiet and a shade easier again at 1s. 1½d. per lb., with citric offering at 1s. 4½d. per lb. Oxalic acid continues very dull at 5½d. per lb. Commercial acetic acid is in moderate demand and fairly steady at £46 per ton for 80 per cent., and glacial at about £65.

With the actual export demand for pitch of small dimensions, prices are weaker again, and £5 to £5 10s. per ton, f.o.b., represents to-day's value here. A good home and foreign demand for creosote oil is still being met with and values are steady at 9½d. per gallon. Solvent naphtha is rather quiet but firm at 1s. 3d. per gallon. Carbolic acid is weaker inclined, crude being quoted at about 2s. 9d. per gallon, and crystals 1s. per lb. Naphthalenes are fairly active but without change at £19 per ton for refined and £6 to £11 for crude.

Company News

BLEACHERS' ASSOCIATION.—An interim dividend is announced at the rate of 5 per cent. actual, less tax, on the ordinary shares.

CAPE EXPLOSIVE WORKS, LTD.—The transfer books of the 7½ per cent. first mortgage debenture stock of the company will be finally closed on December 18.

NATIONAL DRUG AND CHEMICAL COMPANY OF CANADA, LTD.—The transfer books for the 6 per cent. cumulative first preference shares will be closed from December 17 to 31, both days inclusive.

PINCHIN, JOHNSON AND CO.—The directors announce usual dividend at the rate of 6½ per cent. per annum, less tax, on the preference shares for the six months to December 31, payable on January 1.

AMERICAN CYANAMID.—A dividend of \$1½ per share on the preferred stock, and \$1 per share, plus \$½ extra, on the common stock, is announced payable on January 2 to holders of record December 15.

UNITED PREMIER OIL AND COKE CO., LTD.—The registers and transfer books of the 6 per cent. debenture stock and 7 per cent. cumulative preference shares will be closed from December 18 to 31, inclusive, for the preparation of warrants for the interest and dividend for the half-year ending December 31.

THE "SHELL" TRANSPORT AND TRADING CO., LTD.—The ordinary share transfer books will be closed from December 10 to 24, both days inclusive, for the preparation of an interim dividend of 2s. per share, free of income-tax, payable on January 5, to those shareholders on the share register on December 8.

BRITISH BURMAH PETROLEUM CO., LTD.—The directors will recommend to the shareholders, at the ordinary general meeting on December 18, a balance dividend of 4½d. per share, free of tax, making 7½d. per share, free of tax, for the year to July 31 last, payable February 22 next to shareholders on the books of the company on January 14. This is the same as for the previous year.

NIGER MINERALS CO.—Mr. Joseph E. Trigge, who for many years was associated with the Niger Co., and since December last has been managing director of the Niger Minerals Development Co., which has dealt with the mining section of the Niger Co.'s business, resigned the latter position on December 7. Mr. Trigge intends to continue his interest in West African affairs, and has taken offices at Surrey House, Victoria Embankment, London, W.C.2, the former address of the Niger Co.

IDRIS AND CO.—The report for the year ended October 31 last states that after charging all depreciation and debenture interest, the profit is £15,667, as compared with £12,536 for 1922. The balance brought forward amounts to £3,408. The following dividends are recommended:—On A preference shares, 6 per cent.; B preference shares, 7 per cent.; A ordinary shares, 10 per cent.; B ordinary shares, 10 per cent.; founders' shares, 5 per cent., leaving a balance to carry forward of £4,075.

EGYPTIAN SALT AND SODA CO.—The net profits for the year ended August 31 were £52,088, and £48,808 was brought forward. A dividend of 7½ per cent. is proposed, and £44,546 carried forward. The company's net profits were £101,254 for 1921-22, and 17½ per cent. was paid, while £21,535 was set aside. For 1920-21 the distribution was 22½ per cent. out of profits of £123,833, for 1919-20 30 per cent. out of £207,302 earnings, and for 1918-19 45 per cent. out of £219,819 net profits.

BRIMSDOWN LEAD CO.—The directors state that negotiations for amalgamation with other important firms carrying on business similar to the company's own, referred to at last annual general meeting, have recently made further progress. In these circumstances directors feel it would be inadvisable there should be a public discussion of company's affairs until they are in a position to submit a definite proposition for shareholders' consideration. Meeting, Great Eastern Hotel, Liverpool Street, E.C., December 21, at 2.30.

SHAMVA MINES, LTD.—The directors have declared an interim dividend (No. 36) of 5 per cent. (1s. per share), less tax, for the quarter ending December 31, 1923, making 22½ per cent. (4s. 6d. per share) for the year ended on that date, payable January 10, 1924. The transfer books will be closed from December 19 to 24, inclusive. Coupon No. 36 attached to share warrants will be paid on and after January 10 at the

rate of 1s. per share, less tax, at the Midland Bank, Ltd., 5, Princes Street, E.C. Coupons must be left at that bank four clear days. For the year 1922 the dividend was 27½ per cent.

SULPHIDE CORPORATION.—The report states that the net profit for the year ended June 30, after providing £57,324 for future taxation, amounted to £220,961, which contrasts with £82,832 for 1921-22. An interim dividend of 10 per cent. has been paid on both preference and ordinary shares, and a further dividend of 5 per cent. is now proposed on both classes, leaving a balance of £63,461. The dividend for the preceding year was 10 per cent. on the preference and 5 per cent. on the ordinary shares. A sum of £50,000 is to be placed to reserve for contingencies (against *nil*), and £13,461 is carried forward. The report states that a larger final dividend would have been recommended but for the necessity of husbanding cash resources in consequence of the fire in the underground workings of the Central Mine. This fire is still smouldering, although it is hoped that before long the water, which is being poured into the mine at the rate of about 12 million gallons a week, will be completely effective. In order to bring about an earlier resumption of milling operations the Junction Mine at Broken Hill was purchased last month for £75,000. The total extraction from Central Mine was 114,685 tons (against 120,603 tons). Deducting this from the ore reserves and allowing for 27,095 tons developed during the year, there remain 1,255,590 tons awaiting extraction.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

HEAVY CHEMICALS FOR THE NETHERLANDS.—A firm of wholesale dealers in Almelo are desirous of obtaining the sole agency of British chemical works for the sale in Holland of heavy chemicals, including caustic soda, sodium-sulphide, bichromates, bleaching powder, sulphate of alumina, potash, alum, etc. (Reference No. 640.)

Drugs and Chemicals for Egypt

THE British Commercial agent for Egypt has forwarded to the Department of Overseas Trade copies of the documents issued by the Egyptian Ministry of the Interior in connection with a call for tenders for the supply of miscellaneous drugs, chemicals, etc., required by the Department of Public Health during 1924-25. The schedule of stores required is divided into six divisions, viz.:—(1) Proprietary articles; (2) druggists' sundries; (3) surgical dressings; (4) crude drugs and heavy chemicals; (5) fine chemical products; and (6) galenicals and packed articles.

Tenders will be received by the Director of Stores, Department of Public Health, Cairo, up to noon on January 14, 1924. Article 5 of the conditions of tender states that "the articles supplied must be exactly similar to the standard sealed pattern, kept at the Central Stores, Department of Public Health, Cairo, and in number, weight and measurements in accordance with the written schedule or size roll given to the contractor by the Director of Stores. The standard pattern will be sealed by the Department and by the contractor." It is also stipulated that the tenderer must be a person residing in Egypt or must have a representative there and will give in his offer an address at which notices may be served upon him. This Department will be pleased to furnish any United Kingdom firms desirous of tendering and not represented locally with the names and addresses of United Kingdom merchant firms established in Egypt, who would be prepared to handle tenders on their behalf. A copy of the schedule of stores required, conditions and form of tender, may be seen on application at the Department, while a further set of these documents is available for loan to firms in the provinces who may be unable to arrange for a London representative to call at the Department of Overseas Trade, 35, Old Queen Street, Westminster.

Tariff Changes

NIGERIA.—Under a recent revision of the Customs tariff the export duty on palm oil and on palm kernel oil is £2 per ton.

SIERRA LEONE.—The export duties on palm oil and gum copal have been abolished as from November 26.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

BURGIN, Mr. A., The Laboratory, Northern Road, Wickersley, near Rotherham, druggist. (C.C., 15/12/23.) £20 18s. 3d. November 7.

COOPER, THOMAS, 12, Charles Street, Sunderland, wholesale

drysalter. (C.C., 15/12/23.) £11 13s. November 3.

SCHOLES (JOHN R.) AND CO., LTD., 14-15, Argyle Chambers, 67, Hanging Ditch, Manchester, chemical merchants. (C.C., 15/12/23.) £15 5s. 7d. October 29.

Receivership

SURREY CHEMICAL CO., LTD. (R., 15/12/23.) W. R. Theobald, 143, Bow Road, E., was appointed receiver on November 27, 1923, under powers contained in £400 debentures dated March-April, 1922.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

BARNESLEY CHEMICAL CO., LTD.—(M., 15/12/23.) Registered November 26, £15,000 debentures; general charge. *£10,000. March 14, 1923.

BRITISH BURMAH PETROLEUM CO., LTD., London, E.C. (M., 15/12/23.) Registered December 1, mortgage created out of the United Kingdom (supplemental to Trust Deed dated January 16, 1922, securing £600,000 2nd debenture stock and premium of 5 per cent.); charged on properties in Upper Burma. *£125,001. January 12, 1923.

CLEMENT AND JOHNSON, LTD., London, W.C., chemists. (M., 15/12/23.) Registered December 3, £38,600 debentures part of £60,000; general charge. *£38,700. January 12, 1923.

CYPRUS SULPHUR AND COPPER CO., LTD. (late NEW LYMNI, LTD.), London, E.C. (M., 15/12/23.) Registered November 30, £1,300 1st debentures part of £20,000; general charge. *Nil. July 5, 1923.

PHARMACISTS' MUTUAL SUPPLY ASSOCIATION, LTD., Leeds. (M., 15/12/23.) Registered November 30, £500 debentures; general charge. *Nil. December 23, 1922.

SOMERSET OXIDE AND OCHRE CO., LTD., Bristol. (M., 15/12/23.) Registered November 26, £6,000 debentures, to Branch Nominees, Ltd., 15, Bishopsgate, E.C.; general charge. *£2,188 14s. 1d. February 23, 1922.

WALKER (J. B.) AND CO., LTD., Hull, oil refiners. (M., 15/12/23.) Registered November 27, mortgage (collateral to £8,000 debentures), to Bank; charged on properties in Oxford Street and Freehold Street, Hull (in part subject to prior mortgage). *£9,758. June 1, 1923.

London Gazette

Companies Winding Up Voluntarily

CHAMBERS AND HAMMOND, LTD., Lightcliffe, Yorks, chemical engineers. (C.W.U.V., 15/12/23.) N. R. Dickinson and Thos. Paton, 260, Swan Arcade, Bradford, appointed joint liquidators. Meeting of creditors at the Great Northern Hotel, Bradford, on December 13, at 3 p.m.

HILL (ALFRED) AND SONS, LTD. (C.W.U.V., 15/12/23.) W. H. Shaw, Market Place, Dewsbury, Chartered Accountant, appointed liquidator. Meeting of creditors at the offices of the liquidator on December 20, at 11 a.m.; claims by December 31.

STANDARD TABLET CO., LTD. (C.W.U.V., 15/12/23.) H. B. C. Baldwin appointed liquidator.

Notice of Intended Dividend

GREENHALGH, John, Victoria Works, Levenshulme, Gorton, oil and edible fat merchant. First and final dividend of 7s. 3d. per £, payable December 21, 27, Brazenose Street, Manchester.

New Companies Registered

JOHN J. CLARK AND CO., LTD., 18, Southwark Street, London, S.E.1. Wholesale and retail chemists and druggists, etc. Nominal capital, £1,500 in £1 shares.

COTY (ENGLAND), LTD., 3, Gray's Inn Place, London, W.C.1. Perfume manufacturers, dealers in salts, alkalis, drugs, etc. Nominal capital, £25,000 in £1 shares.

ELLIS JONES AND CO. (STOCKPORT), LTD., Tiviot Colour Works, Manchester Road, Stockport. Colour and chemical manufacturers, drysalter and general merchants. Nominal capital, £30,000 in £1 shares.

J. M. HUBER, LTD., 69, Southwark Street, London, S.E. Manufacturers, importers and exporters of and dealers in all kinds of colours, paints, varnishes, stains, dyes, dye-stuffs, chemicals, oils, etc. Nominal capital, £2,000 in £1 shares.

HYDRO CARBON DISTILLATION SYNDICATE, LTD., 277, Finsbury Pavement House, London, E.C.2. To acquire and turn to account certain patents for inventions relating to improvements in the construction of apparatus for and the processes of distillation of oils, tar, pitch, etc. Nominal capital, £5 in 1s. shares.

LEE AND POLLARD, LTD., Priestree Road, Sutton-in-Ashfield. Dyers and finishers; dealers in chemical, industrial and other preparations and articles, drugs and dyeware, etc. Nominal capital, £3,000 in £1 shares.

NEWBRIGHTS, LTD., Ings Lane, Brough, East Yorks. Manufacturers, refiners and preparers of and dealers in blue, blacklead, starch, ultramarine, paints, pigments, varnishes, dyes, colours, etc. Nominal capital, £30,000 in £1 shares.

STANDFAST DYERS AND PRINTERS, LTD., Caton Road Works, Lancaster. Dyers, bleachers, etc. Nominal capital, £60,000 in £1 shares.

STOVOIDS, LTD., Clare House, 57, Kingsway, London, W.C.2. Manufacturers of and dealers in briquettes and patent fuels, etc. Nominal capital, £1,000 in £1 shares.

THE STREAM-LINE FILTER CO., LTD., 64, Victoria Street, Westminster, London, S.W.1. To acquire the exclusive right to the benefit of an existing invention of Dr. H. S. Hele-Shaw and others relating to filters, together with certain pending applications for patents; to carry on the business of manufacturers of and dealers in filters, etc. Nominal capital, £72,000 in £1 shares (20,000 7½ per cent. cumulative preference and 52,000 ordinary).

UNITED COKE AND CHEMICALS CO., LTD., Moss Bay, Workington, Cumberland. Coke manufacturers, miners, smelters, tar distillers, manufacturers and suppliers of chemicals, manures, explosives, gas-dyes, etc. Nominal capital, £150,000 in £1 shares.

VOLDEK SOAP CO., LTD., 15, Henthorn Street, Oldham. Soap manufacturers. Nominal capital, £2,500 in £1 shares.

WORLD LIST OF SCIENTIFIC PERIODICALS. Registered on December 6, the objects being to take over from the proprietors an unpublished manuscript (referred to as the World List), being a list of periodicals containing the results of scientific research with an indication of the libraries in Great Britain where such periodicals are to be found, together with all books, documents and papers relating to the "List." The management is vested in a Council, the first members of which are: Sir A. Schuster, P. C. Mitchell and R. L. Mond. Solicitors: Taylor and Humbert, 4, Field Court, Gray's Inn, London, W.C.1.

